







THE  
**Daily Express**  
ENCYCLOPÆDIA

VOL. II  
BEDSTEADS TO CIGARS





THE  
**Daily Express**  
ENCYCLOPÆDIA

*INCLUDING 3500 ILLUSTRATIONS  
WITH ATLAS & GIZETTEER INDEX*



VOL. II  
BED to CIG

1934  
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# ILLUSTRATIONS

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## PRONUNCIATION

THE imitated pronunciations are intended to assist the reader in the enunciation of unfamiliar words, and necessarily, especially in the case of foreign words, only afford a rough approximation to the actual sound. The signs used are to be pronounced as follows —

a	..	as a in hat	o	.	as o in not
ah	..	„ a in father	ō	.	„ o in note
ā	.	„ a in hate	u	..	„ u in but
ār	.	„ ar in hare	ū	..	„ u in tune
aw	.	„ o in more	ur	.	„ ur in lure
e	..	„ e in bell	oo	..	„ u in put
ē	..	„ e in bee	ōō	..	„ oo in boon
ēr	..	„ eer in deer	ou	..	„ ow in now
ē	..	„ { e in herd, or 1 in bird	ū	..	„ a in comma
1	..	„ 1 in bit	th	..	„ th in think
ī	..	„ 1 in bite	dh	..	„ th in there
īr	..	„ 1 in fire	gh	..	„ ch in loch
			zh	.	„ s in pleasure

Other consonants are given their ordinary English sound.

Bedsteads have been in use for many thousands of years. In early times the mattress was formed of hide strips with the head and foot boards richly ornamented and carved. In mediæval times not only were the wooden parts of the bed heavily ornamented but rich hangings and canopies were in vogue and this form persisted until the middle of the 19th cent. The mattress was usually a row of wooden slats with a feather bed over them. The present tendency is for great simplicity of design without head and foot and the utilisation of finely grained woods without any ornamentation.

Beds were not used by the common people until comparatively recent times and the practice of sleeping on the stove still persists in Slavonic countries.

In various countries such as Scotland and Brittany wall beds were used for many years. These were built like a cupboard with sliding doors and were designed to ensure some privacy for members of households where only one room was used for living and sleeping. In the United States in order to economise in space bedsteads that collapse and fit vertically into a niche in a wall are in common use.

The Great Bed of Ware (1 ft. by 1 ft.) is an historical curiosity.

**Bed Warmers.** The old-fashioned warming pan consisting of a copper receptacle heated by means of hot bricks was placed between the sheets and removed before the person went to bed. This means was superseded by hot water bottles. Electrically heated blankets and pads have been invented which can be switched on or off at will by the person in bed.

**Beech** (*Fagus*) a woodland tree represented in Britain by *Fagus sylvatica* the wood of which is used commercially. The tree is sometimes used as a hedging plant. For garden purposes the copper beech (*F. cupressata*) and the purple beech (*F. purpurea*) are two handsome trees for large spaces and lawns. *F. heptaphylla* (or *asplenifolia*) is the cut leaved beech of ornamental merit and the weeping

beech green or purple foliage (*F. pendula*) is very decorative.

**Beecham, Sir Thomas** (b. 1879) 2nd Baronet conductor and musician. One of the world's finest conductors and a philanthropist in the cause of music. He first appeared as a conductor in 1905 at the Queen's Hall and in 1909 founded the Beecham Opera Company. To him is due the first production in this country of works of the calibre of Delius's *Visage*, *Romeo and Juliet*, Strauss's *Posenka*, *Mozart's Il Seraglio*, Moussorgsky's *Boris Godunov* and *Ivan the Terrible*, Borodin's *Prince Igor* and Rimsky-Korsakov's *Coeur d'Or*. After a long career of

artistic success and financial failure the Beecham Opera Company was wound up soon after the War. Sir Thomas reappeared as conductor of the London Symphony Orchestra.



Sir Thomas Beecham.

His interest in opera manifested itself once again in 1927 when he announced his scheme for an Imperial League of Opera which though it received wide support has still (in 1933) to come to fruition. He conducted for the Russian Ballet during its last appearances in London. He is now the permanent conductor of a new and brilliant orchestra—the London Philharmonic.

**Beecher Henry Ward** (1813-1887) American preacher and opponent of slavery was a brother of Harriet Beecher Stowe. He became famous as minister at Brooklyn (1847-87). He founded and edited the *Independent* (1861-3) and took an active part in the Civil War on the Republican side. He published many religious works.

**Beef-eaters** originally the women of

the Guard, founded by Henry VII (1485), whose attendance at the coronation banquet may perhaps account for their name (*Fr buffetier*). The Warders of the Tower have been known as Beef-eaters since the time of Edward VI, and 15 became Yeomen Extraordinary of the Guard. Their uniform has changed little since Tudor times.

**Bee Fly**, a family of flies (*qv*), so-called from their resemblance to bumble bees due to their hairiness, colour, and the shape of their bodies. They feed mostly on nectar sucked from flowers by a long proboscis, but their larvæ are parasitic, feeding mainly on the larvæ of other insects belonging to a variety of orders.

**Beef Olives**. Pieces of meat (usually chuck steak)  $c 3 \times 2\frac{1}{2}$  in in size, rolled round some form of savoury forcemeat, and braised (*see* BRAISING). They are tied around with string, to keep in shape during cooking. The olives are brushed with glaze before serving, and placed on hot piped potatoes.

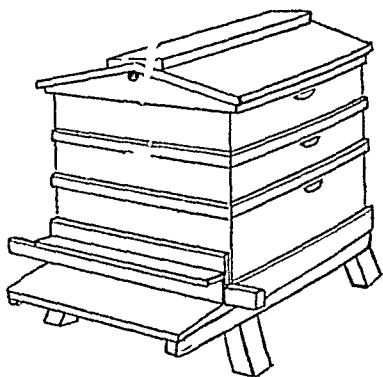
**Beef-steak Club** was first founded in 1709, as a dining-club for men, and was succeeded in 1735 by "the Sublime Society of Steaks," among whose members were Garrick and Hogarth. It was located at various premises until 1867, and in 1876 was revived by the well-known actor, J. L. Toole.

**Beef-steak Pudding**, *see* SUET CRUST.

**Beekeeping** is a profitable industry in several ways. As fertilisers bees are not surpassed by any group of insects, and they are of incalculable benefit to fruit-growers. The honey they produce from substances otherwise of no value is a valuable food, and the wax is useful for polishing and other purposes.

**The Hive**. The old-fashioned straw hive, or "skep," has been almost universally replaced by the movable-comb hive. There are many varieties, but they are all made on the same principle, and consist externally of a wooden rectangular case, supported on a pedestal, supplied with a movable lid, and having an alighting board and

a slit at the bottom on one side for the entrance and exit of the bees. The hive within is furnished with standardised rectangular frames, set side by side, with sufficient space between and all round them to allow room for air, and for the bees' activities. Each frame surrounds a thin sheet of wax, impressed with a hexagonal pattern, of which the meshes are the diameter of a bee's cell. On these sheets the bees build their combs for the rearing of young bees, and storage of honey. Above these frames are set a series of wider, but otherwise much smaller frames, called sections, each calculated to contain about 1 lb of honey in the



Modern Bee hive

comb. These, and the large frames below them, can be easily removed when the top of the hive is taken off.

**Honey Extraction**. Honey was formerly extracted from the frames by heating, squeezing, or draining, but it is now usually done by means of a rotating machine, large enough to hold a frame in a horizontal position, and called an extractor. The rotation causes the honey to flow by centrifugal force. When examining a hive, or removing the honey, it is wise to be prepared for attack by the bees. For this are required: gloves, a muslin veil, black for preference, stretched across a stiff broad-brimmed hat, and a "bee-smoker," a small bellows con-

taining glowing rags or brown paper. With the bellows smoke which renders the bees less aggressive can be puffed into the hive.

**Bee Ailments** Bees are liable to a variety of diseases of which the most serious is known as foul brood. Others are dysentery and the so-called Isle of Wight disease.

**WORKS OF REFERENCE** A. J. Cook *Manual of the Apiary* F. R. Cheshire *Bees and Bee-keeping* Annie D. Betts *Practical Bee Anatomy*

**Bee Louse** a minute degenerate louse-like wingless fly supposed to be related to the forest flies and bat louse (*qv*) but laying eggs instead of producing young in the larval condition. It is met with in hives where it is parasitic on the queen and drone bees the larva feeding on honey.

**Beelzebub** a name used in the New Testament for the devil. Literally it means Lord of the Flies. The name of the Philistine deity presiding over the city of Ekron.

**Beer** a drink made from grain which is allowed to germinate producing an enzyme called *diastase*. The germinated grain is then killed, dried and cured at a gentle heat, the product being known as *malt*. The diastase contained in malt possesses the power of converting the starch of the grain into malt sugar or *mallose*. Like many other sugars (but not cane-sugar) this is converted by the growth of yeast contained in it into alcohol and carbon dioxide. The resulting liquor contains various substances derived from the ingredients and giving it a characteristic taste and flavour, a little sugar and a small percentage of alcohol. An important adjunct is the use of hops and hop extract which give beer its bitter flavour and also act as a preservative by preventing the growth of injurious organisms. Hops also contain tannic acid which combines with and precipitates proteins which would be injurious to the finished product.

**Malting** carried on by the maltster, to some extent a separate industry from brewing, malt being manufac-

tured and sold. The grain is first freed from dust by being shaken in screens and is then sometimes kept warm or sweated to ripen it before germinating. The barley is then *steeped* in water since the hard dry grain will not germinate without this process which requires from 3 to 4 days the water being frequently renewed. This also effects a further cleansing of the grain. Then follows *couching* i.e. allowing the grains after steeping to lie in beds on the *malting floor*, the depth of the masses of grain being regulated according to the season of the year so as to preserve a definite temperature of 54 F. The rootlets now make their appearance thus being technically termed *casting* or *thrown out*. Besides the enzyme diastase already mentioned other enzymes are produced which attack and dissolve the cellulose and proteins. The whole art of malting consists in so regulating these processes that they shall occur to a sufficient degree but no farther. Barley may remain on the malting floor for about a fortnight during the whole of which time it needs attention.

The germinated grain is then taken to the kiln where it is first dried and then heated to a definite temperature at which certain chemical changes take place. Malting is a highly skilled business and different malts are required for the different types of beer and stout. The temperature finally attained reaches about the boiling point of water and thus results in the destruction of all life in the malt whether of the germ or other organisms. What is known as a *pneumatic drum* is also used for the production of malt, the steeped barley being transferred to a long iron drum which can be very slowly rotated (about once in half an hour or more). This enables the air supply and temperature to be controlled with scientific precision and the results obtained are thus less subject to the human element of judgment.

**Brewing** from malt is a fairly simple



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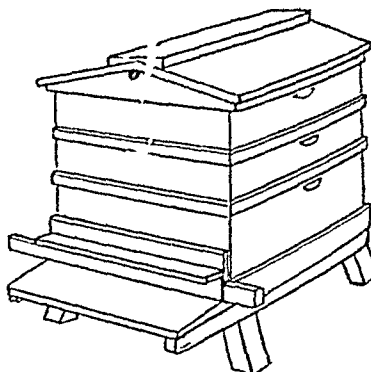
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process, but the results obtained depend upon a variety of factors, some of which are controllable and others not. The importance of the water used needs no emphasis, the most famous beers, such as those of *Burton*, *Munich*, and *Pilsen*, certainly owe their fame very largely to the qualities of the local water. In modern times, a careful study of water has made it possible to produce anywhere water of a composition suitable to brewing. An important constituent is *gypsum*, or sulphate of lime, which causes the "permanent" hardness of most waters, that is to say, the hardness which cannot be removed by boiling. Many waters do not contain it, but it can readily be supplied.

Malt is not the only substance employed as a food for the yeast in the brewing of beer, *invert sugar*, made by the action of acids on cane-sugar, and *glucose* being also used. So long as these substances are pure there is no objection to their use, and in many ways the beer produced from them is more likely to be pure than that produced from pure malt and hops, the nature of which is apt to be variable.

For the preparation of the *wort*, the malt is crushed between rolls, thus forming *grist*, and is then mixed with water, or "liquor," as it is called by the brewer, in the *mash-tun*. Here it is brought to the required temperature by means of steam coils. The temperature employed varies, but may be about 150° F. The mash is then allowed a period of rest, during which the action of the enzymes on the starch takes place, with the production of maltose or malt sugar. The wort is then run off into the *copper* for boiling, here sugar and hops are added. For the production of heavy beer, a considerable volume of water is evaporated, but this is not done for most present-day light beer. The hops yield up their extract and much nitrogenous matter is precipitated by the tannic acid which they supply. Their aromatic flavouring bodies are largely driven off with the steam, and

hence hops are again added to the beer in the cask in order to impart their flavour. It is obvious that the boiled wort is sterile, and the goodness of the final beer now depends upon preserving it from infection by undesirable organisms, and supplying only such yeasts as will have a desirable effect. It is an advantage to cool the wort as rapidly as possible, and at the same time to aerate it while hot, as this improves the brilliance of the beer. The wort is therefore sprayed hot over the *coolers*, which are formed of corrugated copper sheets cooled by cold or iced water.

Various systems of fermentation are employed, but all of them depend upon the action of yeast, and in modern brewing the greatest attention is paid to the purity of the strain employed. Strains are cultivated from single cells, in order to ensure that they should be pure, and their qualities are then tested by practical experiment. A suitable pure strain having been found, it may be used alone, or at most mixed with another pure strain. In fermentation, the wort requires to be skimmed at intervals. The temperature employed is about 60° F., the yeast last rising to the surface of the vat at the end of the process serves to protect the finished beer during the process of settling, after which it is racked off into casks. The process of fermentation is not always conducted in a single vessel, better results being obtained by transferring the partly fermented wort (*dropping it*, as it is termed) into another vessel in which fermentation is concluded. In the *Burton* system the second vessel consists of a cask or *union*, having a pipe through which the yeast as it rises is expelled by the gas (carbon dioxide) produced during fermentation.

Beer is stored in the cask for some time to enable secondary fermentation to continue, whereby the amount of sugar is reduced, and the flavour improved. Sugar is frequently added at this stage, so as to cause by its fermentation the generation of a large quantity of gas. In order to accelerate

the clearing of the beer *finings* are added usually a solution of isinglass. Heavy beers require to mature for a period of 5 to 7 weeks but lighter beers require less time. When bottled a further similar period is required before the beer is suitable for drinking. In order to avoid this loss of time artificially prepared carbon dioxide is sometimes added during bottling.

See J. Ross Mackenzie *Brewing and Malting* (London 1921).

**Beerbohm, Max** (b. 1879) English essayist and caricaturist contributed to the *Yellow Book* (1894-7) and as dramatic critic of *The Saturday Review* proved a worthy successor to Bernard Shaw (1898-1906). His style is polished and his substance witty as *The Works of Max Beerbohm* (1896), *The Happy Hypocrite* (1897), *Zuleika Dobson* (1911) and *Seven Men* (1919) show. Beerbohm has lived in Italy since 1910. In his first volume he fore-shadowed Cubism in art.

**Beersheba**, ancient town at the S end of Palestine nearly 50 m from Jerusalem. There are a number of wells providing a water supply for the Bedouin of the area. The whole of the district has been under prolonged investigation for subterranean water with a view to developing this part of S. Palestine.

**Bees** are stinging insects of the order *Hymenoptera*. They are related to ants and wasps but are distinguished by the expanded basal joint of the hind foot and the feathery texture of the hairs of the head and thorax. Bees feed mainly on nectar and pollen and the adherence of pollen to their feathery hairs makes these insects the most efficient fertilisers of blossoms. Some like the carpenter bee and leaf-cutting bees (*q.v.*) are solitary. Others such as the bumble bee (*q.v.*) and honey bee are social and like ants and wasps have developed a worker caste consisting of normally sterile females. Of these social bees the most interesting and important is the common honey or hive bee. In the honey bee the three castes are readily distinguished. The

male or drone always developed from an unfertilised egg may be known by his large eyes. The fertile female or queen is larger than the worker or sterile female the abdomen especially being longer and projecting well beyond the wing. Both worker and queen are developed from fertilised eggs the difference between them being due to diet.



drone



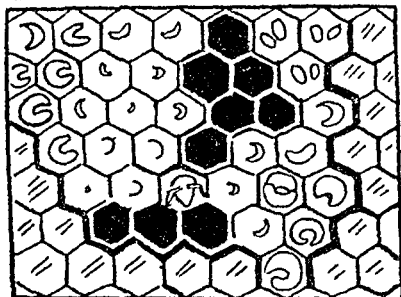
queen



worker

The honey bee also differs in its economy from the bumble bee. The queen does no work; her sole function being egg laying; the colony maintaining itself throughout the year by means of stored honey. Cells or honeycomb for storage of honey and for rearing young bees are made by the workers from wax secreted on the lower surface of the abdomen.

each brood-cell the queen lays an egg, those destined to become queens being deposited in larger cells. The maggot-like larvæ are all at first fed upon the same food, which is regurgitated from the worker's stomach, and mixed with secretion from its salivary glands, but after about the fourth day the worker larvæ are reared only on honey and digested pollen, a diet which prevents their turning into queens. The larva ultimately pupates, and is then sealed up in the cell. The bee, on emerging from its pupal case, bites its way to freedom. The queen larvæ, on the contrary, are fed throughout until they pupate, upon the same food, the "royal



Cells showing development of larvæ. Black cells are empty. Those marked " " are still covered with wax.

jelly," which has the effect of maturing the sexual glands.

**Life of the Worker.** The workers rear new queens, when the overcrowding of the hive makes the sending out of a swarm desirable, and a swarm of workers, led by the old queen, takes its departure to form a new colony before the emergence of a new queen.

The first act of the new queen is to destroy the others, while still in the pupal stage. She then takes her nuptial flight with the drones and returns to the hive to carry on the work of egg-laying, producing eggs at the rate of 1200 or more a day in the season, so that a community may consist of as many as 200 drones and some 80,000 workers. Before the winter the drones, being useless

mouths to feed, are killed, and the colony remains quiescent during the cold weather. Queens may live three or more years, but the life of a ceaselessly toiling worker is probably not more than a couple of months.

**Beeswax,** a secretion of worker bees, found in honeycombs. It is obtained by removing the honey from the combs and placing the latter in boiling water, the wax then melts and rises to the surface, whence it is skimmed off. The colour of the wax obtained varies in different centres of production from pale yellow to almost black. See also OILS, FATS, AND WAXES.

**Beet-fly,** see PESTS.

**Beethoven, Ludwig van (1770-1827),** German composer, born at Bonn. His grandfather, of Belgian descent, was a musician employed by the Elector of Cologne, and his father a singer at the same Court. His musical education began when he was 4. By the time he was 10 he could play both violin and pianoforte. He was also instructed in the organ by Van den Feden and his successor, Neefe, whose assistant he later became. His first composition, a set of variations, was written when he was 10, and published 3 years later. At 12 he was a member of the opera orchestra, and had surprised his elders by his pianoforte improvisations. He continued composing, and in 1787 visited Vienna and played to Mozart, who was greatly impressed by his powers of extemporisation. In the same year his mother died, and the young Beethoven became largely responsible, owing to his father's increasingly dissolute habits, for the welfare of the family. As his powers slowly developed he won the interest and respect of some influential people, including Count Waldstein (to whom he later dedicated the Waldstein Sonata), and when he was 21 the Elector himself sent him to Haydn in Vienna, with whom he studied for 2 years. His now notorious taciturnity, brusqueness, and indifference to social refinements were already evident, but throughout his lifetime these forbid-

ding externals did not blind his friends to his unique qualities. He was received into the highest Viennese society his eccentricities respected as manifestations of genius. It was not until he had been in Vienna for 3 years that he made his first public appearance playing his 1st Piano Concerto (Op 15). He appeared a year later at Nuremberg Prague and Berlin with great success. In 1800 his 1st Symphony (Op 21) was performed and in the same year the disease which later resulted in his total deafness began to alarm him with the result that his despondency and intolerance increased. The joyous 2nd Symphony (Op 36) first performed in 1803 gave no indication of its composer's secret troubles however. The same year his oratorio *The Mount of Olives* decidedly one of his less inspired works was produced but with the 3rd Symphony—the *Eroica*—the next most important work a great advance in his manner is strikingly evident and a succession of works far removed from the Mozartian objectivity of the Op 18 string quartets and the 1st and 2nd Symphonies begins. The other most important works of this great and productive second period are the 5th 6th (1st) and 7th Symphonies and to a lesser degree the 4th and 8th the 4th (*Empero*) and 5th Piano Concertos the Violin Concerto the *Waldstein* and *Appassionata* Sonatas the Op 59 (Rasumoffsky) group of string quartets and the opera *Fidelio*. By this time Beethoven was recognised and honoured as a great composer throughout Europe. His genius was unquestioned if sometimes misunderstood and his material rewards were certainly more proportionate to his merits than in the case of Mozart. Nevertheless his troubles increased. His deafness became more acute and domestic troubles embittered him still more. But as the man became more inarticulate and removed from the world by his tragic infirmity the artist became more eloquent. The great works of the later period—the *Ham-*

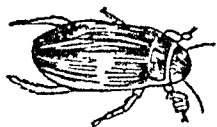
*merklavier* and the Op 111 Piano Sonatas the *Missa Solemnis* (Op 123) and the great 9th Symphony—are the strongest and most superb expressions of his unconquered spirit just as the other worldly last quartets are its beautiful sublimation. A 10th Symphony was planned early in 1817 but he died before it could be written. Beethoven's works include 9 symphonies 2 Masses 5 pianoforte concertos 1 violin concerto 38 pianoforte sonatas 18 string quartets 1 opera and other orchestral and chamber music works and songs.

**Beetles** insects (*q v*) of the order Coleoptera. They are distinguished by the fore wings forming horny plates the elytra which cover the membranous hind wings folded beneath them and almost always meet in a straight line. Sometimes the hind wings are absent and the elytra joined together. The jaw are of the biting type and metamorphosis is complete but the larvæ vary in structure from active comparatively long legged creatures resembling some adult members of the Apterygota (*q t*) to legless comparatively inactive grubs. In the pupal stage the legs and antennæ are free not adherent to the body as in the pupa for instance of the butterfly. Beetles of which there are many thousand different species belonging to numerous families distinguished by a variety of structural characters are found in all habitable parts of the world. Most are terrestrial living on the ground or on plants but some are aquatic. Their diet varies from smaller animals like other insects or worms to vegetable matter. A few are useful scavengers but a great many in the larval stage are pests and destructive to crops timber etc.

**Beetle Stones** see CONCRETIONS.

**Begbie, Edward Harold** (1811-1891) English author and journalist published nearly 50 books and contributed to periodicals. First took up farming but later moved to London and joined the *Daily Chronicle* and later the *Standard*. He wrote books of popu-

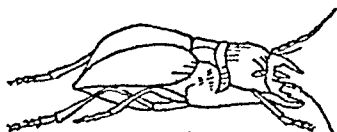
# BEEETLES



water beetle



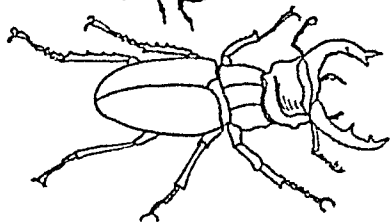
burying beetles



tiger beetle



glow-worm



stag beetle



cucujo



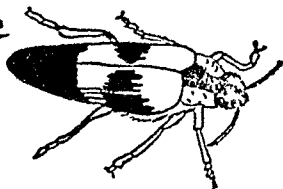
devil's coach horse



cayenne longicorn



oil beetle



chrysochroa



longicorn beetle



blister fly



cockchafer

much literature for children. During the World War he did valuable propaganda work and later wrote his best known work under the pseudonym of A Gertlerian with a Durrer in which various anomalies and injustices were exposed. Among his other works the best known were *I shen I ashenka e Ooker Sheep In the Hands of the Lotter* and his *Life of General H. A. A.*

**Beggar** a person who solicits alms. Beggings in a public place is the offence of being an idle and disorderly person and endeavouring to obtain alms by exposure of wounds the offence of being a rogue and vagabond. It is also an offence to procure a child to beg in a public place. See also VAGRANT.

**Beghards**, mendicant religious association of laymen who flourished in the Netherlands in the 13th cent. They later became infected with heresy and were suppressed in the 14th cent. by Pope Innocent X.

**Begonia**, genus of plants of the family Begoniaceae divided into three cultural classes. Fibrous rooted (winter flowering), tuberous rooted (summer flowering) and the Rex (ornamental leaved). The colours of the flowers (single and double) range from white to yellow, pink, scarlet and red. All are tender subjects and need glasshouse treatment. Propagation is by seed or cuttings.

**Beguines** a Roman Catholic sisterhood founded as an institution for pious widows or single women and still existing in Belgium. They are vowed to obedience and chastity. In 1311 they were condemned by the Council of Vienne for immoral practices.

**Behaim** (or *Bekem*) Martin (c. 1440-1507) German geographer and map-maker. discovered astronomical methods of ascertaining latitude. His theories regarding the terrestrial globe though famous proved very inaccurate.

**Behaviourism** see COMPARATIVE PSYCHOLOGY.

**Behistan**, a village in Persia where on the face of a precipitous

rock 100 ft high inscriptions were chiselled in Babylonian and Old Persian characters by Darius King of Persia in c. 516 and deciphered by Sir H. Rawlinson. They are a statement of the monarch's ancestral right to the Persian throne.

**Behmen Jacob** see BORNHUM. **Behn, Aphra** (1640-1689) English novelist and playwright. author of *Oroonoko* based on the history of an African prince whom he met during her childhood in Surinam. She was employed in the secret service by Charles II (1666). *The Power* (167) is the best known of her plays which are marked by the coarseness of her time.

**Beira** [BA BHA] (1) Central Portuguese province S of Minho Tras os Montes and N of Estremadura and Alentejo. The surface is composed of low hills in the N rising to the Sierra de Estrella in the centre and of plains along the coast and in the S.E. Crops of fruit, olives and cereals are produced and there is plenty of pasture land. The climate is pleasant and warm and rice is grown in several places. Minerals are not of particular importance but include iron, coal and lead. The chief towns are Coimbra, Ligueira, Aveiro and Vizeu. Area 9,400 sq. m. pop. (1930) 1,000,000. (2) District of Portuguese F. Africa centring around the town of Beira which stands at the mouth of the Busi R. some miles N of Sofala. The chief products of the district are sugar, rubber, ivory, gold, cotton and coconuts. The climate is pleasant and healthy and Beira is becoming a popular seaside resort from the interior. Pop. c. 17,500 including 2,000 whites.

**Beirut** (*Dayrout*) seaport and seat of Government of the Lebanese Republic (190). There are two Universities, American and French, both having a faculty of medicine, also a School of Arts and Crafts. Tobacco is grown in the area and the silk industry is steadily assuming importance. There is an air mail service between Beirut and Marseilles and a good service of European steamers. During the World War it



was occupied (1918) by General Allenby. It is intended to be made one of the two Mediterranean termini of the Iraq oil pipe line that is to carry petroleum across the Syrian Desert to the Mediterranean coast. Pop (1929) 134,655.

**Beit, Alfred** (1853-1906), S African financier, was associated with Cecil Rhodes in the amalgamation of his De Beers' and Barnato's Kimberley diamond mines, in the British South Africa company and in the Jameson Raid (1896). He left huge sums to educational institutions and endowed the chair of colonial history at Oxford.

**Beith, John Hay** ("Ian Hay") (b 1870), English novelist and playwright, is best represented by such works as *The First Hundred Thousand*, *Knight on Wheels*, and *Tilly of Bloomsbury*. He excels in the humorous vein, and has collaborated with Commander Stephen King-Hall in a series of comedies dealing with naval life.

**Béla Kun**, see KUN, BÉLA

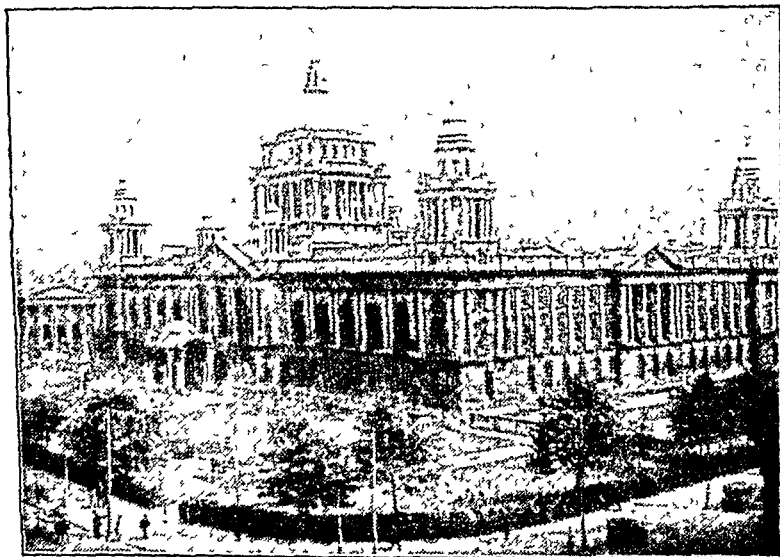
**Bel and the Dragon**, an Apocryphal book of the Old Testament, in the Vulgate (q v) version, part of the Book of Daniel.

**Belasco, David** (1853-1931), for many years one of the most noted dramatists and producers in the U S A. Among his outstanding successes were *Madame Butterfly*, *The Darling of the Gods*, and *The Girl of the Golden West*.

**Belaying-pin**, see CLAT

**Belem**, suburb of Lisbon, Portugal. Pop c 10,000. A monastery was erected here to Vasco da Gama, to celebrate his discovery of the route to India. The church contains the tombs of Vasco da Gama and Camoens.

**Belemnites**, extinct cephalopod molluscs, akin to cuttle-fish. They arose in the Trias, and persisted to the end of the Cretaceous, dying out with the ammonites (q v), to which they were distantly related. Another form, called *Spirula* with a coiled shell, is



Belfast Town Hall

in existence to-day in some tropical oceans but is rare

Belfast, capital of Northern Ireland (1871) and chief sea port and commercial centre of the country situated on Belfast Lough. A well laid-out city it has grown considerably in recent years possessing a number of imposing buildings amongst which should be mentioned the City Hall (built on the site of the Old Linen Hall) Parliament Buildings and Queen's University. Shipbuilding and linen are two of the earliest and most important industries others in lude iron founding rope-making distilling and brewing. Pop (19 6) 415 000



Belfast. Clock tower. Bartbold Lion commemorating the siege 11870

Belfort (BELFOR) (1) Territory of 235 sq m in E France bounded by Haut Rhin Switzerland and Doubs. The land is both wooded and arable and there are copper silver and lead mines. Industries include brewing cotton and wool spinning and machinery. Pop (1931) 99 400 (2) Important fort and capital town of Belfort territory. The scene of much fighting notably during the Franco-German War 18 70-1. Pop 36 000

Belfry. The word had originally nothing to do with bells but meant a watch tower. From the fact that

these towers usually contained an alarm bell the modern connotation is derived. The word now may mean either a bell tower or the place in the top of a church tower where the bells are hung. A notable example of a mediæval bell tower is the belfry of Bruges with its fine carillon.

Belge one of the tribes encountered by Cæsar in his Gallic wars. A warlike people of German race they dwelt in the N of Gaul in what is now N France and Belgium.

Belgian Congo (Congo Belg) Belgian colony of Central Africa consisting of the Congo basin and a small part of the extreme S Nile basin bounded N by the Egyptian Sudan and French Equatorial Africa S by N Rhodesia W by Angola and Middle Congo and E by Tanganyika Territory. The surface consists of hills in the SE and E sloping through a low plateau to plains in the NW. The colony possesses a very short coast line at the mouth of the river. Lakes Mweru Kivu and part of Tanganyika are within the colony.

Though decidedly unhealthy the Belgian Congo is a territory of great natural wealth. There is an abundance of radium copper gold tin cobalt and diamonds. Rubber ivory and palm oil are of great commercial value and recent experiments in the cultivation of coffee rice and sugar cane are proving successful. The colony is still under-developed owing to the extreme difficulty of transport and organisation. Enormous forests or huge savannah like tracts with rank and tangled vegetation cover much of the land. The navigability of the Congo is a great asset and roads are gradually being constructed. Railways cover in all c 7000 m their work being mainly to connect the navigable parts of the river.

Wild animals including the elephant leopard buffalo and dangerous reptiles abound. The timber industry is not developed although there are trees in great variety.

The natives mainly Bantus are

primitive and backward, but missionary education is gradually being introduced. Government is by a Governor-General, and several provincial Lieutenant-Governors. The value of the native products has given rise to several towns, of which the most important are Leopoldville, the capital, Boma, the chief port, Stanleyville, and Elizabethville.

*History.* The Belgian Congo began as an independent State (the Congo Free State) ruled by Leopold II, who had financed Stanley, the early explorer of the region. By treaty, the State was to be open to traders of all countries, but Leopold made working conditions so difficult that in a short time he had established an almost personal monopoly, exploiting the great natural resources for his own gain. During this time the Congo Free State became a byword for misrule and cruelty to natives. In 1908 the Territory was annexed by Belgium, the principal European States signifying their agreement to this arrangement. Reforms were instituted, a considerable measure of local autonomy given to the natives, and conditions generally improved. Since that time the history of the colony has been one of gradual commercial and cultural advance. Area, 918,000 sq m, pop (1932), 8,900,000 natives, and 22,000 Europeans.

*Belgian Literature.* This must inevitably be divided linguistically into French, Flemish, and Walloon. Belgian French literature had its beginnings in the 18th cent, but the first prominent figures are De Coster, with his *Légende de Thyl Uylenspiegel et de Lamme Goedzak* (1867), and Octave Pirmez (1832–1883). A new impetus was given by Camille Lemonnier (*q v*), whose influence is to be found in almost all the subsequent literature. The most original, and the best known, of Belgian poets is Émile Verhaeren (*q v*), and the greatest name of all in Belgian literature is that of Maurice Maeterlinck (*q v*). Émile Cammaerts (*b* 1878) is another noted Belgian poet.

For more recent writers the reader is referred to J Bithell, *Contemporary Belgian Literature*.

The literary Flemish language is identical with Dutch, and was revived, in spite of official opposition, after the revolution of 1830. The novels of Hendrik Conscience (1812–1883) are aflame with Flemish patriotism, and this may be said also of the poetry of Karel Ledeganck (*q v*). Guido Gezelle (1830–1899) raised and ennobled the plane of Flemish poetry. Later and more modern in spirit are van Langendonck, Hegenscheidt, and Karel van de Woestyne among poets, and Buysse, Streuvels, Vermeylen, and Van de Woestyne among novelists and prose-writers. Among contemporary novelists the most popular is Felix Zimmermans.

Walloon, which is spoken in S Belgium, is a Romance dialect, and the 11th-cent *Eulalie*, one of the earliest monuments of its literature, is likewise one of the earliest in any Romance language. *Aucassin and Nicolette* (*q v*) also belongs, properly, to the Walloon dialect. In 1921 three 17th-cent texts were published—an *Ode*, a *Sonnet*, and a *Morality*. The 18th cent is notable for four comic operas—*The Journey to Chaudfontaine*, *The English Litgeois*, *The Festival of Houste-s'-Plouët*, and *The Hypochondriacs*. To the 19th cent belong the satire *The Disordered Household*, a still popular drinking song, *Li Bourgoyne*, the poems of Nicolas Defrecheux, and the drama *Titi l'Periqui*. As a spoken dialect, Walloon is almost moribund, but the literary dialect still survives in popular dramas, poems, and tales, and appears, indeed, to be very much alive.

Belgium, small European kingdom, lying in about the same latitude as the English S counties. It is bounded N by Holland, S by France, W by the North Sea, and E by Germany and Luxemburg. The coastline is short and unbroken, and at its nearest point is within 50 m of the Kent coast.

The surface of more than half the



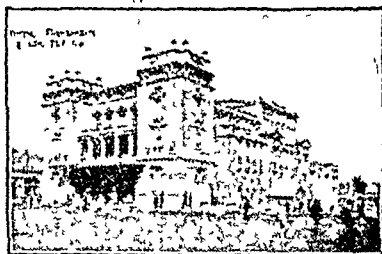
W. Flanders, Hainault, Liège, Limburg, Luxembourg, and Namur

*History* In Roman times Belgium was a part of Gaul, but it has long borne distinctive national characteristics. The Franks followed the Romans as conquerors, and after their fall the country split up, like many other parts of Europe, into independent States, duchies, and countships. In the latter part of the 16th cent the Netherlands were united by marriage to the Holy Roman Empire, and were given to the heir-apparent, who married a Spanish princess, and so began the association between the Netherlands and Spain. At the time of the Reformation, the religious wars kept Belgium Catholic though they failed to influence the Dutch. Years of discontent followed, and in the subsequent Franco-Spanish War much of the country seceded to France, to be partly restored by the Peace of the Pyrenees. In 1700 the last of the Spanish Royal house died without issue, and the Netherlands were willed to a grandson of Louis XIV. This brought about the War of the Spanish Succession, at the end of which Belgium became part of the Austrian dominions. Holland had been for some time independent. The years of Austrian rule were, on the whole, beneficial to the country, which made steady progress. The Congress of Vienna (1815) united Belgium and Holland under William of Nassau, but the union was unsuccessful. The Dutch were inclined to regard themselves as conquerors, and Belgian national feeling grew. In 1830, stirred by the successful revolution in Paris, the Belgians declared their independence, and after a conference of the European Powers, a renewed invasion by the Dutch, and several years of political disturbance, the country's independence was formally recognised and its neutrality declared. This neutrality treaty (1839) was the celebrated "scrap of paper" that the Germans violated in 1914.

In 1914 the country was attacked,

rapidly overrun, and much ravaged by the Germans. The success of the Allies, and subsequent large loans, together with a German indemnity, helped to put Belgium on the way to recovery. Belgian neutrality was abolished by the Treaty of Versailles. Post-War problems have been the international navigation of the Schelde (Scheldt), and the Flemish movement, that was strongly fostered during the German occupation. A severe financial crisis was met successfully in 1925 and 1926. There has been of late years a considerable growth of the Socialist movement. Area, 11,752 sq m, pop 8,000,000.

Belgrade, capital of Yugoslavia, and the seat of government of the Frane Kingdom. Situated on a



Belgrade Theatre

promontory formed by the Save and the Danube, it is considered well watered. There is a Konak or Royal Palace, the scene of the assassination of King Alexander and Queen Draga in 1903, a Skupstina or Parliament, a National Theatre, and a University. Foreign capital has equipped factories, and the State owns a flourishing tobacco factory. Pop (1931) 291,738.

**Belisarius** (c 505-565), famous general of the E Roman Empire. Under Justinian, he won great victories over the Vandals and the Ostrogoths. In 534 he took Carthage, making the Vandal King Gelimer prisoner. In 535 he invaded Sicily and Italy, capturing Ravenna, together with the Ostrogothic King Vitiges. He aroused much envy by his exploits,

and was several times recalled and even degraded and imprisoned. Legend recounts that he became a blind beggar.

Belize town and capital of British Honduras pop. (1931) 16,087 on the R. Belize. The harbour is shallow and the town situated in a region of unhealthy swamps. Its main industry is the export of hardwoods particularly mahogany. Beliz is now a stopping station on the air mail and passenger service to Panama. In 1931 a disastrous hurricane overtook the town and destroyed most of it. Its first settlers were logwood cutters from Yucatan and Nicaragua. Dampier visited it before 1674. These pioneers were repeatedly attacked by Spaniards and it was not until 1850 that comparative tranquillity was secured by a treaty concluded at Washington.

**Bell**, one of the oldest musical instruments. Its peculiar shape gives rise to a sound rich in overtones and this shape has been refined throughout the Christian era during which the evolution of bell-casting took place. The Whitechapel bell foundry founded in 1570 still exists.

The modern shape was first developed in the 16th cent. older bells being generally more cylindrical.

Bells are cast in moulds built up of bricks coated with loam for the core, the outer surface being given by an iron casing also coated with loam. The shape is given by a strickle board, in both cases that is to say a board cut to the correct profile and rotated so as to stroke the loam coating when wet to the right form. The moulds require to be dried very thoroughly before casting.

After casting and cleaning up the bell is tuned by the removal of metal from one or other surface; this process cannot be carried too far without injury to the tone. A truly tuned bell must have all harmonics or *nominals* truly in tune with one another; the bells of a chime or ring as it is technically requiring likewise

to be in tune with one another. Of recent years there has been a great development in the construction of carillon sets of bells which can be made to play tunes or chimes either by hand from a key board or purely mechanically. The largest bell in the world in actual use is in Moscow and weighs 198 tons. In the same place there is a still larger one cast in 1773 but having lost a piece of about 11 tons weight which cracked away in the furnace. The bell has of course never been hung; it weighs about 180 tons and stands over 10 ft high. In London the greatest bell at St. Paul's weighs 16½ tons while Big Ben weighs only 13½ tons.

Bell ringing may be in rounds that is the bells are sounded from highest to lowest note in successive order this being repeated without alteration or *changes* may be rung which means that the regular sequence of highest to lowest notes is altered. The number of *changes* possible depends on the number of bells in the ring. Thus with a ring of three bells only 6 changes can be sounded with four 4 are possible with ten 3,628,800 and with twelve 4,790,016,000. Such totals as the latter two are needless to say only mathematical not practical possibilities. Various methods of change-ringing have been in practice in England for centuries; a revival of interest took place during the Victorian era.

Bell Acton, Currer and Ellis, *see* BROWNE.

**Bell, Alexander Graham** (1847-1923) inventor was born in Edinburgh but removed to Canada at the age of 23. His experience as Professor of Vocal Physiology at Boston and his researches into the teaching of the deaf led to his invention of the telephone in 1876. The photophone and an early gramophone were also invented by him.

**Bell, Sir Charles** (1774-1841) surgeon, lecturer on anatomy and author of a paper on the Nervous System (1801). His treatment of the wounded in the Peninsula War and at Waterloo

and his work at the Middlesex Hospital brought him much fame. He accepted the chair of anatomy at the London College of Surgeons (1814).

**Bell, Chas. Fredk. Moherly**, (1847-1911) journalist joined *The Times* in 1875 and won fame as correspondent in the Arab revolt (1882). He became manager of *The Times* in 1894.

**Bell, Gertrude Margaret Lowthian** (1865-1926), uncrowned queen of Arabia, famous traveller in the East especially in Arabia where she spent most of her time from 1890. She was an authority on Asia Minor and Persia and a journey into the interior of Arabia in 1913 brought her fame. A translator, administrator and propagandist her work during the World War, when she was an associate of Lawrence of Arabia, was invaluable. Her support of King Faisal of Iraq both at and after the Cairo Conference (1921) was largely instrumental in keeping him on the throne. She was greatly revered in Baghdad, where she was Director of Antiquities to the Museum, and where she died. She published several works of travel and of archaeological and administrative interest.

**Bell, Henry** (1767-1830), constructed and launched in 1812 the *Comet*, the first European steam vessel.

**Belladonna**, the *Deadly Nightshade* (*Atropa belladonna*), the poisonous plant from which atropin is extracted, and parts of which are used for various medical purposes.

**Belladonna Lily**, see AMARYLLIDS.

**Bellamy, Edward** (1850-1898), American Socialist writer, author of *Looking Backward, 2000-1887*, and *Equality* (1897).

**Bellarmino, Robert**, Italian cardinal (1542-1621), Professor of Theology at Louvain (1570) and Rome (1576). His best-known work is an attack on the Protestants, *Disputations concerning the Controversies of the Christian faith, against the Heretics of this Time* (1581-93). Bellarmine was a patron of Galileo (1615), and a member of the Society of Jesus. He was canonised in 1929.

**Bellarmino**, a very early product of the Italian pottery. They were first made of stoneware with a white face, in circulation on the coast. Specimens are at the British Museum and the Victoria and Albert Museum. The name is said to be derived from Cardinal Bellarmine.

**Bell-birds**, so called from their bell-like notes, are birds restricted to tropical America. The best-known species is white, and about the size of a jay. It has on its forehead a slender horn of skin, about 3 in. long, said to be divisible with air.

The name has also been applied to unrelated birds in other countries.

**Belle Isle** (1) French island, 12 m. long, off the coast of France on the Atlantic side, S. of Ouberton whose inhabitants are chiefly engaged in fishing and rearing steel. The sardine industry is its mainstay. Admiral Hawke defeated the French off the coast 1759. An English force landed in 1761, the islanders surrendering to a man. It was restored to France by the Treaty of Paris, 1763. Pop. 6700. (2) British island in the Atlantic between Labrador and Newfoundland, with a fine lighthouse. The original breed of the famous Newfoundland dog is said to have come from here.

**Bellerophon**, in classical mythology grandson of Sisyphus, King of Corinth, who was sent by the King of Lycia against the Chimæra, a fire-breathing monster, and against the Amazons, in the vain hope that he would be slain. Later accounts credit him with taming the winged horse Pegasus and using it to subdue the Chimæra. He is reported to have subsequently earned the wrath of the gods by attempting a flight to heaven, in consequence of which he was thrown from his winged steed and lamed.

**Bellini**, family of Venetian painters. **JACOPO BELLINI** (1400?-1470?), one of the first painters in oils, had two sons.

**GIULIO BELLINI** (c. 1427-1507), who spent one year at the Court of Mohammed II at Constantinople, and

completed on his return several public works at Venice. The National Gallery contains three of his paintings including a *Mohammed II*.

**GIOVANNI BELLINI** (c. 1499-1516) introduced a richer style into Italian painting under the influence of Mantegna his brother-in-law. The National Gallery contains ten of his works including *Doge Leonardo Loredano*, *Christ's Agony in the Garden* and four *Madonnas*.

**Bellinzona**, capital of the Canton of Ticino Switzerland pop. (1930) 10,066 at the junction of the routes across the St Gothard to Lugano and Locarno. The Castello Grande the 15th-cent castle of San Michele which rises to a height of nearly 1000 ft is of special interest.

**Bellite** *see* EXPLOSIVES

**Bell Metal**, a special type of bronze containing a high percentage of tin. *See also* BRONZE ALLOYS

**Belloc**, Joseph Hilaire Pierre (b. 1870) essayist, historian and satirist was born at Saint Cloud, France and naturalised in England in 1909. He was a friend of the Chestertons (CeCIL and Gilbert) and his works include *Danton* (1899), *The Path to Rome* (1904), *A Change in the Cabinet* (1909), *The French Revolution* (1915), *Joan of Arc* (1929), *The Hainted House* (1931) and *The Bad Child's Book of Beasts* (1896). He has written several volumes of historical works.

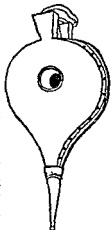
**Bellows**, implement for blowing a fire or supplying a wind instrument such as an organ with air. The ordinary domestic appliance known as a pair of bellows consists of a collapsible leather bag strengthened by wires attached to the inner sides of two boards hinged at one (usually the narrow) end and having handles at the others. The boards are usually pear-shaped though they may be square or circular. Beyond the hinge is the nozzle for expelling the air. In the middle of one of the boards is a hole with a valve.

When the means of

expanded by air flows

through the valve into the leather bag when it is contracted the air being unable to return through the valve is forced through the nozzle. Thus the blast is intermittent. For smith's work requiring a continuous blast a double bellows is used.

Some very attractive pairs of bellows were made in the 18th cent. the boards often being of elm oak or fruit wood carved and decorated. The leather bag was decorated in various ways and the brass nozzle was distinctively ornamental.



Bellows.

**Bell Rock**, *see* INCHCAPE ROCK

**Bells**, the signals struck on a bell which announce the time at sea. A day is divided from midnight into five watches of 4 hours each and two of 2 hours. A bell is rung each half hour the number of strokes telling how many half hours have elapsed. Bells are rung in groups of two thus five bells—one two one two one being two and a half hours after the beginning of the watch. At 4 p.m. the first dog watch begins changing to second dog watch at 6 p.m. the ordinary routine resuming at 8 o'clock. This gives men a change of hours every day.

**Bells, Electric**, *see* ELECTRIC BELLS

**Below** Otto von (b. 1847) German general in the World War distinguished himself first in the defeats of the Russians (Narev and the Masurian Lakes). Later he commanded in Macedonia and in 1918 on the Western front at Arras. In 1919 he resigned.

**Belt, Great**, a channel connecting the



Baltic with the Kattegat, 40 m long and in parts 20 m wide, with a depth of 25 fathoms

**Belt, Little**, channel dividing the Danish island of Lolland and the main land. It is 30 m long and varies from 4 m to 18 m in breadth forming the W. route between the Kattegat and the Baltic

**Belt Conveyor**, *see* CONVEYOR

**Belt Pastes** are used for increasing the adhesion of driving belts. They consist of mixtures of tallow, castor oil and resin, rubber, resin, and asphalt, tallow, wax and rubber, all melted together to form a sticky mass which is then applied to the belt. They also tend to preserve the belt. If the belt still slips, it is a sign that it is being over-loaded, or that pulleys of too small a diameter are being used

**Belts, Driving** One of the commonest methods of transmitting power from one axis to another consists in using a flexible belt passing round a pulley on each axis. Originally both pulleys were grooved, but in the great majority of cases, flat belting running on nearly cylindrical pulleys without flanges is now used. The pulleys must not, however, be perfectly cylindrical, but must have a slightly larger diameter in the centre of the rim than at the two edges. This is necessary in order to prevent the belt from running off the pulley. It is also essential, in using flat belts and flangeless pulleys, that the shafts should run exactly parallel. Flat belting is still usually made from leather, which needs to be of the highest quality, and for first-class results only that portion (about 6 in wide) of the hide covering the spine of the ox can be used, since all remaining leather will stretch unevenly. Textile or woven belting made of hair and cotton is coming into wide use. Canvas belting is made from stout cotton duck folded several times, and dressed with linseed oil and paint. Rubber belting consists of plies of fabric impregnated with rubber with a friction surface of vulcanised rubber. A belt made of cotton canvas impreg-

nated with balata, a substance similar to rubber, has been in use for many years, and gives excellent results.

Textile beltings are also "solid woven" a better method than forming the belt of folded material.

In certain kinds of work "rope-drives" are largely employed, especially in driving textile mills as a means of transmitting power from the main engine. They are also used in mining machinery.

Special types of leather belts working in V-grooves have also been utilised, especially on motor-bicycles, and in similar cases where a high speed is required. The best known of these is the Whittle, which is made of a combination of leather and steel in separate links, which can be readily removed and reconnected. These links run in a groove having an angle of 28°.

**Beluchistan**, *see* BALUCHISTAN.

**Beluga**, *see* WHALES

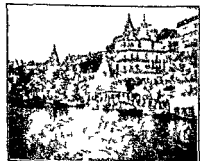
**Belvedere** (architecture): (a) turret in a building commanding an extensive view (Ital. "fine view"), (b) garden summer-house so placed as to command a view, (c) name of palaces in the Vatican and in Vienna.

**Bembridge Beds**, *see* OLIGOCENE SYSTEM

**Benares** (or *Kasi*) (1) town in State of Benares, United Provinces of India, sacred city of the Hindus, and centre of Brahmical learning. Thousands of pilgrims come to bathe in the waters of the Ganges, thereby washing away their sins. Another familiar sight is the cremation of the dead on the burning ghats. The picturesque river-front has many shrines, palaces, and temples. Notable buildings are the Mosque of Aurangzeb, the Bisheshwar or Golden Temple, the 17th-cent. Durga Temple, and the old observatory of Raja Jai Singh. W. of the native town lies the European quarter, containing the Prince of Wales's Hospital, the Benares College, and the Hindu University (1916). The foundation-stone of an Agricultural College was laid in 1920. Chief manufactures are silks, gold and silver

thread brass ware and filigree work.  
Pop (1930) 205 000

(9) State of Benares Produce  
sugar rice barley wheat and opium  
Constituted native State in 1911  
Capital Ramnagar where Maharaja  
of Benares has his palace Area  
875 sq m pop (1921) 362 700



Be es Bathing Ghats.

**Benbow John** (1802-1810) English  
Vice admiral was celebrated in song  
and story for his fight with the French  
(1780) off Jamaica in which he con-  
tinued to give orders even when his  
right leg had been carried away. For  
their disobedience in the battle his  
officers were court martialled. Ben-  
bow died of his wounds.

**Bench** (or *Banc*) in law was origin-  
ally the seat occupied by judges in  
court and so came to be applied to the  
tribunal itself e.g. King's Bench. It  
is now applied to judges or magistrates  
collectively as the judicial bench  
bench of magistrates.

**Bend**, see **HERALDRY**

**Bendigo** (known for a time as *Sand-  
hurst*) town in Victoria Australia c  
90 m N of Melbourne chiefly known  
as a gold mining centre. Gold was  
first discovered in 181 and at first  
large quantities were obtained. When  
the surface deposits were exhausted  
machinery was introduced and the pre-  
sent industry developed. Bendigo is  
also a considerable market town and  
has small leather and metal founding  
industries. Pop (1931) 33 000

**Benedicite** a canticle used in the  
order for Morning Prayer in the Prayer  
Book of the Church of England and  
in the office of Lauds in the Roman  
Catholic office. It is taken from the  
Book of Daniel in the Old Testament  
Apocrypha and has been used in  
Church services since the time of  
St Chrysostom (A.D. 347-407).

**Benedict, St (of Nursa)** (c. 480-544)  
founder of the order of monks called  
Benedictines (q.v.) after him. He  
spent some years as a hermit near Su-  
biaco in Italy in the neighbourhood of  
which he founded several monasteries.  
His main work was the famous Rule  
by which his monks were to be  
governed. The great features of this  
Rule were regularity and good order  
rather than austerity, and he laid great  
emphasis on the value of work. The  
whole monastic life of the Middle Ages  
was influenced by this rule and by the  
order that he founded. He is com-  
memorated on March 21.

**Benedict**, name of fifteen popes of  
whom the first eight are relatively  
unimportant.

**BENEDICT IX** became pope in 1033  
at the age of 12. His evil life led to his  
expulsion and he was succeeded by  
three other popes until in 1037 he  
returned only to be expelled once  
more. **BENEDICT X** was deposed by  
Hildebrand after ruling from 1058 to  
1059. **BENEDICT XI** was poisoned  
after 1 year's reign in 1304. **BENEDICT  
XII** occupied the chair from 1334 to  
1342 and is known for his reformation  
of the monastic orders. **BENEDICT  
XIII** was anti-pope (1394-1403) the  
name was also taken by the pope of  
1744-45 who wrote numerous theo-  
logical treatises. **BENEDICT XIV**  
(1740-58) is known for his wide and  
deep learning and his encouragement  
of scholarship. He took great interest  
in foreign affairs where they affected  
the papal states. He issued bulls  
(1742-4) rebuking the Jesuits for  
altering their teachings to suit heathen  
practices in Chinese and Malabar  
mission fields. **BENEDICT XV** (1914-  
19) b. 1854 was elected 3 Sept. 1914.

and acted with diplomacy during the difficult years of the World War. He remained strictly neutral, and attempted on various occasions to bring about a peace.

**Benedict, Sir Julius** (1801-1885), musician and operatic composer, of whose works *The Lily of Killarney* still enjoys a certain popularity. Benedict was born at Stuttgart, and became a naturalised British subject. He toured in America with Jenny Lind.

**Benedict Biscop** (628?-690), English ecclesiastic, founder of the monasteries at Wearmouth (674) and Jarrow (682), where Bede was taught by him. He was a famous patron of Anglo-Saxon literature and art, and did much to advance culture in England throughout his life.

**Benedictine**, see LIQUORS

**Benedictines**, the Order of monks and nuns which has developed from the Community of Cenobites, founded in the 6th cent. by St Benedict. The Order is bound by the usual monastic vows of poverty, chastity, and obedience, and from its foundation has devoted much attention to the educational work in which it is still prominent. Its monasteries soon sprang up all over Europe, and during the Dark Ages (q.v.) were almost the sole refuges of learning and the relics of Roman culture. The Order still flourishes all over the world, in England the Benedictines have several houses, and their members are engaged in education and in some cases in parish work. The Order has given its name to the liqueur first produced in the early 16th cent. by a monk of the Abbey of Fécamp in France.

**Benediction of the Blessed Sacrament**, a rite of the Roman Catholic Church wherein the priest blesses the people with the reserved Sacrament. It is almost always performed in the evening. It dates from the 16th cent., and has been adopted in certain sections of the Church of England.

**Benedictus**, the canticle of Zacharias, Luke i. 68-79. It is sung or recited at Lauds in the Roman Church and at

Morning Prayer in the Church of England.

**Benefice**, the right to receive the profits of church property in return for the rendering of certain spiritual duties. It does not refer to minor offices, such as the holding of a title by a curate in the Church of England.

**Benefit of Clergy**. Formerly the clergy had a great many privileges, including particularly an immunity from criminal proceedings before secular judges, which was called benefit of clergy. The privilege was greatly extended and abused, applying in the end even to laymen, if they could read. It was cut down by statutes making certain offences felonies without benefit of clergy, e.g. the Piracy Act, 1536, and finally abolished in 1827.

**Benefit Societies**, see FRIENDLY AND BENEFIT SOCIETIES

**Benes** (BENESH), Eduard (b. 1884), with President Masaryk, General Stefaňák, and Rašín may be said to have created Czechoslovakia, of which he was first Foreign Secretary and which he represented at Versailles in 1919. He was formerly tutor at the Czech University, Prague. He was Prime Minister in 1921-2 and became a member of the Council of the League of Nations in 1923. He was re-elected to this post in 1925, and as one of the founders of the Little Entente has played a prominent part in post-War Central European politics.

**Benevento**, Italian city in Campania. Roman remains include a theatre, triumphal arch, and bridge. The old city was destroyed in the 6th cent., and rebuilt in the 7th, it fell to Napoleon, and later was taken from the Pope at the union of Italy. Buildings of architectural importance are St Sophia's Church (8th cent.), the cathedral begun in the 9th cent., and the castle Pop (1931), commune, 37,000.

**Benevolences**, money raised by the King without the consent of Parliament. First used by Edward IV., abolished by Richard III., revived by

Henry VII the system was finally abolished by the B. I. of Rights (1833)

**Bengal, Presidency** British India bordered on N. by Nepal Sikkim and Bhutan and on S. by the Bay of Bengal. The area of the province is 89,935 sq. m. Up to 1838 Bengal included the present North Western Provinces. In 1905 part of Bengal proper with Assam was constituted a new province E. Bengal and Assam whilst the remainder of Bengal with Bihar and Orissa was in 1910 constituted a Lieutenant Governorship.

Bengal in its present form—reconstituted in 1921—consists of all Bengali speaking districts under a Governor in Council. The administration comprises a governor with 4 executive Councillors of whom 2 are Indian whilst the Legislative Council is composed of 140 members. The Presidency has a Supreme High Court with 16 judges. More than half of the population are Mohammedans the remainder (43 per cent.) being Hindus. Eighty different languages are spoken in the Presidency though Bengali is the mother tongue of 9 per cent.

For the most part Bengal is a level plain but there are mountains and hills in Darjeeling Jalpaiguri Chittagong and Tripura. The scenery however is relieved by stretches of forest. The chief rivers are Padma, Jamuna, Meghna, Damodar, Tista, Rupnarain and Hugly. The rain fall is heavy reaching over 200 in annually at the foot of the Himalayas and up to 10 in elsewhere except the W. where the maximum fall is 75 in.

Bengal is the most important rice producing area in N. India no less than four fifths of the cultivated land being given to this purpose. About 2,000,000 acres are devoted to the cultivation of jute. The raw material and jute manufactures accounted in 1927-8 for 6 per cent of the exports. Oil seed cane sugar tea opium and tobacco are other important exports. Amongst the main imports are cotton piece goods machines salt and rail

way materials. Bengal possesses great mineral wealth—iron coal and salt petre being the chief yields. Calcutta on the Hugly R. is the capital as well as the chief town and port. Darjeeling is the hot weather capital.

Bengal is well supplied with railways the total length in 1927 covering over 3,000 m. There are nearly 2,000 m. of navigable waterways. The length of metalled roads is 3,500 m. Pop. (1931) 51,089,000.

**Bengal, Bay of**, part of Indian Ocean between India and Burma. Receives Ganges and Brahmaputra from N. Irrawaddy from E. and Mahanadi and Godavari from W. Andaman Nicobar and Mergui are the chief groups of islands.

**Bengali Language** the language of Bengal is descended through Prakrit (the vernacular parallel to the literary Sanskrit) from the Aryan branch of Indo European languages (see Table INDO EUROPEAN LANGUAGES).

**Bengali Literature** begins in A.D. 1400 with the poet Chandi Das who was followed by a long line of religious poets. The *Mahabharata* and the *Ramayana* (see SANSKRIT LITERATURE) were translated in the 15th cent. Some of the poetry of Mukunda Ram (14th cent.) has been translated into English and the chief work of the 18th cent. was the *Bidya Sundar* of Bharat Chandra. Modern Bengali literature has adopted a large vocabulary from Sanskrit and dates from the 19th cent. The chief writers are Bankim Chandra and Sir Rabindranath Tagore (q.v.). The literature of Assam is a self-contained unit and has produced at least one notable poet in Sankar Deb (15th cent.) beside a great body of dramatic work.

**Benghazi** Italian port of Cyrenaica on the E. of the Gulf of Sidra. The chief export is barley and there are sponge fisheries in the vicinity. Benghazi was founded by the Greeks of Cyrenaica and called Hesperides. Most of the ruins of the ancient town are now buried in the sand. Pop. (1931) 43,000.

**Benin**, district and town in S Nigeria. Local products are timber, rubber, ivory, and palm oil. First visited by Europeans in the 16th cent, it was an influential and remarkably civilised country. Slave-trading grew rapidly. English trade began in the 16th cent, and was fostered. Following the murder of British officials, the country was taken over late in the 19th cent. The small R Benin takes its name from the district, the main river being the Niger. Area, c 3700 sq m, pop. district, 84,000, town, 35,000.

**Bennett, Enoch Arnold** (1867-1932), novelist and dramatist, was from 1889 to 1893 in a London solicitor's office. His first novel appeared in 1898 (*A Man from the North*) and his first volume of plays, *Polite Farces*, in 1899. Thenceforward a stream of novels poured from his pen. His fantastic stories, of which examples are *Grand Babylon Hotel* (1902) and *Buried Alive* (1913), were greatly popular, his serious studies of middle-class life in

the Five Towns of the Potteries (e.g. the *Clayhanger* trilogy, 1910, 1911, 1916, *The Old Wives' Tale*, 1908) constitute his masterpieces; but his stories of modern life of politicians and millionaires (e.g. *Accident*, 1929, *Lord Raingo*, 1926, and *Imperial Palace*), showed a slight decline. His novels of London, *The Pretty Lady* (1918) and *Riceyman Steps* (1923), equal his Five Towns stories. *Milestones* (1912), in collaboration with Edward Knoblock, is his best-known play.

**Bennett, James Gordon** (1795-1872), founded the *New York Herald* (1835). He was succeeded as editor by JAMES GORDON BENNETT (1841-1918), his son, who financed many expeditions—including those of Stanley to Central Africa and the Congo (1874). He lived mostly in Paris, and founded the Paris edition of the *New York Herald*. In 1906 he instituted the Gordon Bennett Challenge Cup for balloon flying, which has been competed for annually ever since, while in 1909 he presented the Gordon Bennett Challenge Cup for aeroplane speed contests to be retained by any country which succeeded in winning it in 3 successive years.

**Bennett, Richard Bedford** (b 1870), Canadian politician. He was first a schoolmaster and later became a well-known barrister. Canadian Conservative M.P. in 1911. During the World War he did valuable service as Director-General of National Service, and in 1921 became Minister of Justice. Five years later he was Finance Minister, and in 1930 became Premier, being created a Privy Counsellor in the same year. He played a prominent part in the Ottawa Conference, and later negotiated an important wheat agreement.

**Bennett, Sir Wm. Sterndale** (1816-1875), composer, one of the most esteemed English musicians of his time. As a boy he sang in King's College Chapel, Cambridge, and entered the Royal Academy of Music at the age of 10. In view of his pre-



Arnold Bennett

cocious talent he was sent to Leipzig to complete his musical education and while there he met Mendelssohn whose influence is to be traced in his works. He founded the Bach Society in 1858 and became principal of the Royal Academy of Music in 1868.

**Ben Nevis**, highest mountain in the British Isles 4400 ft. in Inverness shire a few miles from Fort William pierced by a tunnel some 15 m. long conveying water from Loch Treig to Fort William. Until 1903 the Scottish Meteorological Society's station was on the summit.

**Benson, Arthur Christopher** (186-1892) author son of Archbishop Benson Fellow (1903) and Master (1915) of Magdalen College. His novels include *The Canon* (1906) and *Cassage* (1927) his historical and biographical works several contributions to the English Men of Letters series. Poems and essays increased his reputation. He wrote the poem *Land of Hope and Glory* which Sir Edward Elgar set to music.

**Benson, Edward Frederic** (b. 1867) author son of Archbishop E. W. Ben-

son archaeologist in Greece and Egypt has published many novels including *Dodo*—his first—(1893) *The Chailoners* (1904) *The Osbornes* (1910) and *David of Kings* (1914).

**Benson, Edward White** (1809-1890) headmaster of Wellington College (1850-63) Bishop of Truro (1871) succeeded Dr Tait as Archbishop of Canterbury (1883) to which position he brought considerable organising and administrative ability. He was the father of the three writers A. C. E. F. and R. H. Benson (qqv).

**Benson, Sir Frank R.** (b. 1858) a tor founder of the Benson Shakespearean company was for many years in charge of the Shakespearean festivals at Stratford-on-Avon.

**Benson, Robert Hugh** (1871-1914) author and Roman Catholic priest son of Archbishop E. W. Benson wrote many novels e.g. *By What Authority?* *Come Rack! Come Rope!* mainly dealing with the period of suppression of Roman Catholicism in England.

**Benson, Stella** (b. 1892) English authoress and traveller has journeyed widely in Europe America and the East especially in China where she mainly resides. Her published works include *Twenty* (1918) *The Poor Man* (1922) *Sketches of Travel* (1925) *Tobit Transplanted* (1931) for which she received the Femina Vie Heureuse Prize and *Christmas Formula* (1932).

**Bent Grass** see AGROSTES.

**Bentham, Jeremy** (1748-1832) economist and philosopher was called to the Bar in 1772. His books include the *Defence of Usury* (1787) and the *Introduction to Principles of Morals and Legislation* (1789) in which he defines the principle of utility and claims that the object of legislation must be the greatest happiness of the greatest number. The influence of Bentham's Utilitarian philosophy was enormous and was felt even more abroad than in England. He shared in founding University College London where his skeleton is a treasured relic.

**Bentinck** family name of the Dukes and Earls of Portland.



R. H. Bennett.

BENTINCK, HANS WM (c 1640-1700), 1st Earl (1680), came to England with William of Orange, and was his friend and adviser. His eldest son was created Duke of Portland in 1716.

BENTINCK, LORD WM HENRY CAVENDISH (1738-1809), 3rd Duke, was a Member of Parliament under Rockingham (a Whig) (1761-82) and under Pitt (a Tory), Prime Minister, 1783, 1807-9.

BENTINCK, LORD WM HENRY CAVENDISH (1771-1839), son of the above, as Governor of Madras (1803-7) and Governor-General of India (1827-35), instituted many reforms.

BLANTINE, LORD WM GEO FREDK CAVENDISH (1802-48), son of the 11th Duke, nephew of Geo Canning, was a strong supporter of Protection and a bitter opponent of Peel.

Bentley, John Francis (1839-1902), ecclesiastical architect. Examples of his work are the convent of the Sacred Heart at Hammersmith and the Church of the Holy Rood, Watford. He designed Westminster Cathedral in 1895. He was a master of the neo-Gothic and Byzantine styles.

Bentley, Richard (1692-1742), critic and classical scholar, keeper of the King's Library (1692), is famous for the part he played in the controversy over the *Epistles of Phalaris*, and the subsequent quarrel over the respective merits of ancient and modern writers. Bentley held that the *Epistles* were not genuine, as Boyle, their editor, maintained. The affair was celebrated by Swift, whose employer, Sir Wm Temple, had a small hand in the affair, in his *Battle of the Books*, and by Pope's inclusion of Bentley in the *Dunciad*.

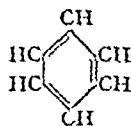
Benué, river of NW Africa, the largest tributary of the Niger. It rises in the Adamawa mountains, in the Kamerun, and flows generally W for c 800 m, to join the Niger.

Benzaldehyde,  $C_6H_5CHO$ , is, when pure, a colourless liquid of a characteristic odour with boiling-point  $180^\circ C$ . It is an important synthetic reagent manufactured by several methods, the principal of which is the oxidation of

toluene with lead dioxide and sulphuric acid. It is purified by distillation. It can also be obtained by treating benzene with a mixture of carbon monoxide and hydrochloric acid gas, the reaction being catalysed by aluminium bromide. It is also found in bitter almonds. Benzaldehyde is used for flavouring purposes, and in perfumery, as well as in the preparation of numerous organic compounds. On exposure to air benzaldehyde oxidises very easily, with the formation of benzoic acid (*qv*).

Benzene (often known commercially as benzol) is an aromatic hydrocarbon of the formula  $C_6H_6$  boiling at  $80^\circ C$  and melting at  $5^\circ C$ . It is obtained commercially by the fractional distillation of coal tar where it is to be found in the lighter fractions, and the yield from an average specimen of coal tar is about 14 per cent.

Benzene is a very stable substance, and may be considered as the parent substance of all aromatic compounds. Numerous theories have been put forward as regards its structure, and the generally accepted structural formula of benzene is



this is usually written as:



Benzene is used as the starting-point for the industrial manufacture of a large number of organic substances, e.g. nitrobenzene, chlorobenzene, azobenzene, etc. By itself it is used as a constituent of motor fuels; it has the advantage of a very high "anti-knock value" (see ANTI-KNOCK AGENTS), it is also used to a considerable extent as a solvent for oils, waxes, and rubber. It should not be confused with benzine (*qv*), which is a

hydrocarbon mixture of an entirely different character See also CHEMISTRY ORGANIC

**Benzine** a mixture of light petroleum hydrocarbons usually with a boiling range of 10-150 C The chief constituents of such a mixture are aliphatic hydrocarbons although aromatic constituents may also be present depending largely upon the oil field from which the crude petroleum was obtained In the United States the term benzine is more often used to designate what is known in Great Britain as petroleum ether that is a light hydrocarbon mixture having a boiling range of about 40 - 60 C

The term benzoline is also sometimes used instead of benzine Important uses are as fuel for internal-combustion engines in dry cleaning and as an industrial solvent

Care must be taken not to confuse benzine with *benzene* (qv)

**Benzoic** [pron BEN zō IK] Acid,  $C_6H_5COOH$  is a white crystalline substance soluble in hot water and with a melting point of 121 C

Benzoic acid is used to a considerable extent as a food preservative although the trend of recent legislation has somewhat discouraged this It is also employed in the seasoning of tobacco and in the manufacture of dyes such as aniline blue

Medicinally benzoic acid is used as an antiseptic and for the manufacture of benzoated lard (i.e. lard which will not go rancid) which is employed as an ointment base

Benzoic acid is found free in nature in considerable amounts in various gums of which the chief is gum benzoin obtained from an Oriental tree This should not be confused with benzoin (qv) a synthetic organic compound

**Benzoin** [pron BEN zō IN] (*Phenyl benzoica binol*) is a colourless crystalline organic compound of formula  $C_6H_5CH(OH)COC_6H_5$  melting at 137 C It is manufactured by the condensation of benzaldehyde (qv) by means of cyanide It

should not be confused with gum benzoin (see BENZOIC ACID)

**Benzol**, the commercial name for benzene (qv)

**Beowulf** the hero of the great Anglo-Saxon epic of that name (written down about 1000) The story is divided into two parts the first concerned with Beowulf's great fights against a monster Grendel and its mother both of whom he destroys the second deals with his conquest of a terrible dragon and the capture of its treasure The poem ends with the death festival of Beowulf and the burning of his body Innumerable controversies have arisen over the poem among English German and Scandinavian scholars but its position remains unassailed as perhaps the greatest literary production of early N Europe

**Bequeath** to give by will in strict law the term is applicable only to a legacy of personal property but may now also be used in a will to transmit real property the proper word for which is *devise*

**Béranger** Pierre Jean de (1801-1857) Fr song writer famous mainly for *Le Roi d'Yvetot* (a satire on Napoleon) and *Le Vieux Drapeau* (a revolutionary song) His collection of songs (published 1815 1818 1830) annoyed the authorities and he endured two terms of imprisonment for his Socialist ideas but his popularity with the people was enormous and in 1848 he was elected to the Constituent Assembly

**Berar** see CENTRAL PROVINCES AND BERAR

**Berbera**, port and caravan centre of British Somaliland on the Gulf of Aden The harbour can accommodate large vessels and there is a considerable trade in gum skins resin sheep and goats imports include cotton goods and dates Pop c 15 000

**Berber Language** a Hamitic language (qv) the various dialects of which are spoken by millions of people in N Africa as far S as the Sudan but



chiefly in Morocco and parts of the Sahara. Its alphabet has 32 letters written in a very ancient character peculiar to this language.

**Berbers**, see **AFRICA**, **PROPER** OF

**Berchtold, Leopold, Count von** (b 1803), Foreign Minister to Austria-Hungary, 1912-15, he hastened Austria's ultimatum to Serbia so that she might have no time to offer satisfaction and war was declared. He urged Germany, as Austria's ally, to attack Russia.

**Berenice**, the name of several Jewish and Egyptian princesses, of whom the most famous were (1) wife of Ptolemy Soter and mother of Ptolemy Philadelphus who gave her name to the city of Berenice. She was deified after her death. (2) wife of Ptolemy III (c 248 B.C.). Her hair, which she had vowed to Venus for her husband's safety in his Asiatic wars, having disappeared from the temple, it was said by the priest to have been placed in the sky amid the stars. A constellation, *Coma Berenices* gained its name from this event, which is also celebrated in Catullus's translation of a poem by Callimachus.

**Beresford, Charles Wm, 1st Baron** (1840-1919), English admiral, joined the training-ship *Britannia* in 1859, and rose to the rank of rear-admiral by 1897. His bravery on board the *Condor* during the bombardment of Alexandria in 1882 gained him promotion. He retired in 1911 and was M.P. for Portsmouth till created baron in 1910.

**Beresford, John Davys** (b 1873), English novelist, was articulated and practised as an architect until 1906. His novels include *Goshings* (1913), *The Invisible Event* (1915), *Signs and Wonders* (1921), *The Monkey Puzzle* (1925), and *Seven Bobsworth* (1930). His other works comprise stories and volumes of collected essays and criticisms.

**Berezina, Battle of the** (Nov 28, 1812) the Grande Armée in their retreat from Moscow under Napoleon I were attacked while crossing the river

by the Russians under Chichagov and Wittgenstein, losing 36,000 men.

**Bergamo** (Lat. *Bergamum*), historic Italian town of Lombardy, c 30 m S.E. of Lake Como. The old town stands on a hill, and is connected with the new town in the valley. There are several ancient churches and buildings, and an art gallery. Textiles are manufactured in the town and neighbourhood. Pop (1931), (commune) 82,000.

**Bergamot, Oil of**, an essential oil obtained by expression from the rind of the bergamot fruit. It is a pale-green limpid fluid with a powerful but pleasant odour, which is due to the presence in the oil of linyl acetate. The oil is used in perfumery. The industry is cultivated principally in S. Calabria.

**Bergen** [BÄRGÜN], Norwegian port and county on the W coast, N of Stavanger, with a well-protected harbour, modern dock accommodation, and quay, it is the second largest trading centre in the country. The main export is fish, others are butter, hides, and copper. Imports include machinery, foodstuffs, and coal. There are important local industries of ship-building, distilling, and paper-making. Bergen is also a large railway and tourist centre. It has been a famous port since the Middle Ages, and has many associations with the Hanseatic League. Pop (1930) 98,300.

**Bergen-op-Zoom**, Dutch town in N Brabant, on the R. Zoom. There is a large beet-sugar industry, and trade in anchovies and oysters. The town is of ancient foundation. It was held by the Normans in the 9th cent., and was a flourishing commercial centre in the Middle Ages. Pop (1932) 22,000.

**Bergerac, Cyrano de** (1619-1655), French satirist and dramatist, in the Rabelaisian vein, is famous for his wild adventures and his great nose, and as the subject of Rostand's play bearing his name (1897). His biography by Lcbret is amusing.

**Bergson, Henri Louis** (b 1859) Born in Paris of Jewish parents, educated at the *Lycée Condorcet* and

**L'École Normale** Professor of Philosophy at the *Lyce d'Angers* from 1881 to 1893 since 1900 Professor at the *Collège de France* Bergson believes that systems that take space into account are wrong and that we should state relationship in terms of time In *Creatio Evolution* he states that time is a process of change in which all parts are interpenetrating in which the past is carried into the present therefore there is a continual creation His object was to uphold the doctrine of free will against mechanistic determinism For Bergson life is a struggle against matter which he regards as a vital impulse arrested

Bergson's popular lectures have attracted big audiences in Paris Oxford and London Some of his numerous works have been translated into English among them *Time and Free Will* (1910)

**Beri Beri**, disease occurring in Japan and China, due to a deficiency of Vitamin B in polished rice The symptoms of the disease are either palsy or dropsy The former generally begins in the legs and spreads up the body until the muscles of respiration are fatally affected The dropsy is usually uniformly distributed throughout the subcutaneous tissues and is due to impairment of the functions of the heart which becomes dilated

**Bering Vitus** (1681-1741) Danish explorer discovered the Bering Sea and Bering Island (1771) during his expedition that reached America (1798) from Siberia and Kamchatka

**Bering Island**, an island in the Bering Sea off the coast of the Far Eastern Area of the USSR The climate is extremely cold and the island barren seal fishing is the main occupation The island and sea are both named after the explorer Bering Area, 800 sq m pop c 00

**Bering Sea**, N sea between Alaska and N E Siberia frequently icebound near the coasts It contains a number of island groups including the Aleutians in the N komandarskis Priby

lov Nunivak and others Seal fishing is important

**Berkeley George** (1695 1753) Irish divine and philosopher fellow of Trinity College Dublin (1707) Bishop of Cloyne from 1734 to 1752 The influences of Newton Descartes and Locke led to his formulation of his philosophy in 4 *New Theory of Vision* (1709) *Principles of Human Knowledge* (1710) and a Platonic dialogue *Alciphron* (1733) He insisted on the spiritual nature of matter and claimed that nothing that was not perceived existed He also published works on social and economic problems and is said to have greatly influenced Kant

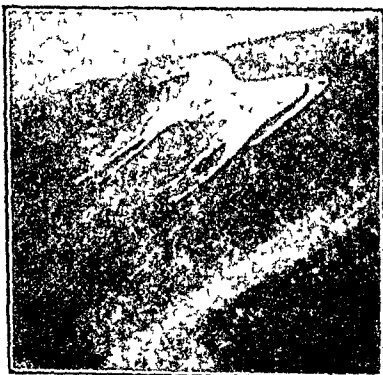


Bishop Berkeley

**Berkshire** S county of England bounded N and E by the Thames W by Wiltshire and S by Hampshire and Surrey The surface is rolling the main elevation being the Berkshire Downs culminating in Inkpen Beacon (850 ft) on the slope of which is the famous Great White Horse an enormous chalk representation believed to commemorate one of King Alfred's victories The county is well watered by the Thames Kennet Pang Ock and other rivers and is well wooded and fertile The countryside is typical of the S of England containing many delightful spots and several historic towns including Windsor Maidenhead and Abingdon The principal occupation is agriculture chiefly stock breeding Dairy farming is important and the county has given its name to a well known breed of pigs Considerable areas are under wheat and oats and root crops and fruit do well several famous seed firms have their headquarters in Berkshire The chief industrial town is Reading which

has grown considerably within recent years

Berkshire has a number of ancient remains from the time of Neolithic



Berkshire Downs Great White Horse

man onwards, there are several Roman roads

Buildings of note are Windsor Castle, Reading University and Sandhurst College. The county town is Reading Area, 463,830 acres, pop 311,334

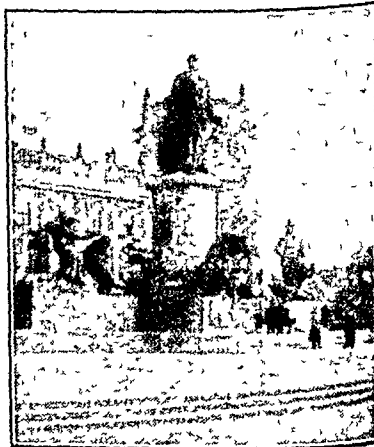
Berlin, Irving (b 1888), pseudonym of Israel Baline, American composer of popular songs, his *Alexander's Ragtime Band* (1911) and *Always, Remember and What'll I do?* (1925) were the beginning of popular "jazz"

Berlin, capital of the Prussian Republic, and of the German Reich. Berlin is one of the finest and most populous cities of Europe. It lies on the R Spree, and is connected by canals with the Oder and the Elbe. By reason of its commanding geographical situation, the leading political position of Prussia among the other German States, and the capacity and vigour of its inhabitants, Berlin has gained a foremost place as a manufacturing, financial, and trading centre. Its greatness dates from the union of the States into the Empire, the victories of 1866 and 1870, when it became the capital and the seat of imperial government.

Though post-War depression has

affected Berlin adversely, its manufactures represent almost every branch of industry, notably engineering, textiles, publishing, brewing, and metal goods. Smaller, but still considerable, are the manufacture of earthenware, pianos, furniture, carpets and fabrics, and working in precious metals. As a financial centre Berlin ranks not far behind London and New York. It is also a great railway centre.

Owing to its rapid modern growth there are few historic buildings, though there are many exemplifying modern architecture. Among the former may be mentioned the Kloster Kirche, the Royal Palace, and the Marien Kirche. The newer buildings include the University, Kaiser Friedrich Museum, various palaces, municipal and government buildings, cathedral, library, and Opera House. The celebrated Unter den Linden is one of the longest and finest streets in Europe. Others of note are the Wilhelmstrasse, Viktoriastrasse, and



Berlin Bismarck Statue

Behrenstrasse. There are many monuments, squares, and gardens including the beautiful Tiergarten, and the Schlossbrücke, a fine ornamented bridge.

Berlin is a famous cultural centre its university and schools are of the first order its orchestra and opera world famous

took the single name during the 15th cent. It sustained severe loss and damage in the Thirty Years and Seven Years Wars Since Berlin

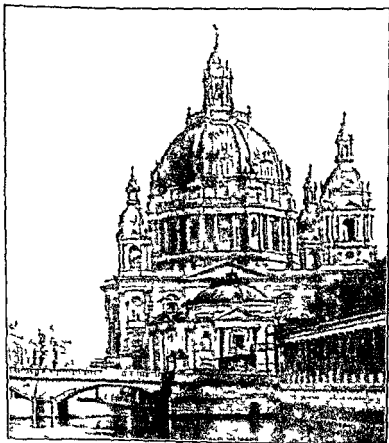


Fig. 1. Protestant Cathedral (on the Spree)

Modern conditions have necessitated excellent systems of town planning local transport drainage and sanitation. Berlin is not of ancient foundation. It sprang from the union of two small

and Berlin and

became the Prussian capital at the beginning of the 19th cent. Its increase in size and population has been remarkable. Pop. (1930) 4,300,000.

Berlin Conference (1894) held to decide the question of the Congo

territory in Africa. King Leopold II of Belgium, at the head of an organization nominally commercial and international, known as the Congo Association, had financed the explorations of H. M. Stanley (q.v.) and obtained a vast territory in W. Africa. France and Portugal, alarmed at this, demanded a Conference of Great Powers, which set up the Congo Free State with Leopold II as its personal ruler, with provisions for international control.

Berlin Congress, called in 1878 at the conclusion of the Russo-Turkish War 1877-8, to settle the Balkan question. The settlement, under the Treaty of San Stefano (q.v.), had aroused the opposition of Austria and Great Britain, and Bismarck, pro-Austrian in policy, offered himself as the "honest broker" at this Conference to settle disputed points between these two Powers and Russia. By secret negotiation with Disraeli, prior to the Conference, Bismarck attempted to bolster up Turkish power. He agreed with Russia to accept the main clauses of the treaty of San Stefano, provided that the Big Bulgaria created by that treaty was divided into three, one part, Macedonia, to be restored to Turkey, and another, E. Rumelia, to form a province directly under Turkish control, but with some autonomy. He agreed with Turkey to occupy Cyprus and support the Sultan, with force if necessary, should Russia gain certain territory in Asia Minor, notably Kars and Batum. These proposals passed the Congress, and by his revelation of the secret treaty with Turkey, Disraeli prevented Russia from gaining much territory in Asia Minor. In addition, Bosnia and Herzegovina, though remaining nominally Turkish, were handed over to Austria for administration, and Montenegro, a pro-Russian nation, acquired less territory under the provisions of the Congress than under those of San Stefano.

Berlin Decrees, *see* CONTINENTAL SYSTEM

Berlin, Treaty of, *see* EASTERN QUESTION, *Inf.*

Berlioz, Hector (1802-1869), French composer, born near Grenoble, was destined at first to be a doctor. But he managed to become a student at the Paris Conservatoire, where, despite his respect for his master Lezard, he despised the institution as a whole, having small respect for its academic atmosphere. A Maecenas was given at the church of St. Roch, but the first important outside recognition of his early genius came with the bestowal of the Prix de Rome in 1830 on the strength of a cantata, *La Mort de Sardanapale*. He became a music critic to support himself and his wife, the Irish actress, Henrietta Smithson, but found time also to write some of his finest works, *Harold in Italy*, *Roméo et Juliette*, *Bertram*, *Cellini*, and the *Requiem* written to the order of the Fr. Government. He made a successful tour abroad, where his works were held in greater regard than in his native country. His *Damnation de Faust*, presented (in its original cantata form) in 1846, and his opera *Les Troyens* (1863), both had an unfortunate reception. Berlioz's music, besides being in itself of the greatest beauty and originality, has been of the first importance in the development of modern orchestration. His mastery of instrumentation is one of the most striking features of all his finest works.

Bermondsey, London borough S of the Thames, adjoining Southwark on the E. Rubber, chemicals, leather, metal goods, and many other commodities are manufactured. Bermondsey possessed a Royal palace in Norman times, and was the site of a famous abbey, to which pilgrimages were made. Pop. (1931) 111,526.

Bermudas, a group of just over 350 islets, forming a British Crown Colony in the Atlantic, c. 600 m. due E. of Charleston, U.S.A. The colony has a land area of not more than 20 sq. m., most of the islets being little more than rocks. About 20 are inhabited. The climate is excellent,

and the colony is a busy one fisheries and agriculture flourish and potatoes and other vegetables bulbs and bananas are produced A large revenue accrues from summer visitors from Canada and America

On Ireland Island there is an important naval station with a floating dock and a garrison Imports are principally from the U.S.A. and consist of foodstuffs machinery and clothing The islands are administered by a Governor an Executive Council appointed by the British Crown a Legislative Council of 9 members and an elected House of Assembly of 36 members The chief



Berna da Governm t H se

town is Hamilton (pop 3000) the only other town of note is St George

The Bermudas were discovered by a Spaniard Juan de Bermudez in 1515 They were settled in the early 17th cent by a party of British colonists including Sir John Somers who were shipwrecked there (1609) and renamed them Somers Islands In 1684 when the Bermudas were taken over by the Crown they were governed by a Company of the City of London

Bernadotte, see CHARLES XIV OF SWEDEN

Bernard, Claude (1813-1881) Professor of Physiology at the Collège de France (1835) made physiological researches which explained the full functions of the pancreas and liver He discovered the vaso motor system and experimented with poisons

Bernard, St. (c 1090-1153) famous preacher the founder and first abbot of Clairvaux (1115) the greatest of Cistercian monasteries His writings were devotional rather than philosophical or theological in the narrower sense and his practical nature is seen in his rule for the Knights Templars (1127) his reconciliation of schismatics and arrest of heresies and in his work for the second crusade (1146) His writings include theological works and hymns He was canonised 20 years after his death Feast Aug 20

Bernardin de Saint Pierre (1737-1814) Jacques Henri French engineer and botanist is best known as the author of *Paul et Virginie* (1787) which is world famous

Bernardine of Siena, St (1380-1444) Franciscan friar and famous revivalist preacher in Italy founded the Observant branch of his Order and was famous for both his sermons and his writings Feast-day May 6

Berne Swiss canton between Trieburg on the W and Unterwalden on the E composed of the Jura Mountains on the N divided by a wide valley conducting the Aar and other rivers from the Alpine mountains of the Bernese Oberland in the South Among the notable peaks are the Jungfrau (13 670 ft) Schreckhorn and Eiger Lakes include those of Thun and Brienz Much of the soil is fertile cereals vegetables and fruit are successfully grown Dairy farming is an important industry Stone-quarrying and iron mining are of value Woollens leather goods and watches are important industries The town's traffic produces a large annual revenue

Berne the chief town and capital of Switzerland is situated on the R Aar The town is famed for its magnificent views of the Alps It is a notable trading centre for agricultural produce and has local manufactures of textiles sweetmeats and some machinery Public buildings of note are the ancient cathedral palace and library Many of the houses are of

considerable architectural merit. The town was founded towards the end of the 12th cent. It successfully repelled the onslaughts of various European princes, and established its independence, the canton began as the territorial possession of the city. It sided with the Reformation, and is still mainly Protestant. Area of canton, 2650 sq m. pop. canton 689 000, town (1930) 112,000.

**Berne Convention**, see COPYRIGHT

**Berners, Gerald Hugh** (b 1853), 9th Baron, English diplomat and composer. His opera *Le Carrosse du Saint Sacrement* was produced in Paris in 1921. While filling a diplomatic post in Rome his three satirical funeral marches were performed at the Teatro del Piccolo (marionette theatre) in that city. Perhaps the most popular of his works, which include songs, pieces for piano and orchestra, is his witty *Fugue*.

**Berners, John Bourchier** (c 1467-1533), 2nd Baron, was one of Henry VIII's courtiers, and, at his request, translated Froissart's *Chronicle* (1523-5), and *The Golden Boke of Marcus Aurelius* (pubd 1534). His versions were widely popular and influenced subsequent English prose style.

**Bernese Oberland**, the S part of the canton of Berne, embracing the Thun district and Lake of Brienz as far as Grimsel, with the two valleys of Lauterbrunnen and Grindelwald. The highest peaks of the Bernese Alps are the Finsteraarhorn (14,026 ft), Aletschhorn (13,720 ft), and the Jungfrau (13,670 ft).

**Bernhardi, Friedrich von** (1849-1930), German militarist, is famous for his *Germany and the Next War* (1912), which caused much discussion on its publication. He advocated a policy of ruthless aggression and complete disregard of treaties, and regarded war as a "divine business". He was generally supposed to be the spokesman of German feeling prior to 1914.

**Bernhardt, Sarah** (1845-1923), one of the world's greatest actresses, b of Jewish parents in Paris, was first

noticed in 1807, when with the Olean company. In 1874 her interpretation of Racine's *Phèdre* established her fame. From 1880 to 1893, the *Dame aux Camélias* (Dumas fils) and *Fraustön* (Meilhac et Halévy), also *Fedora*, *La Tosca*, and *Cléopâtre* (three plays specially written for her by Sardou) were performed by her all over the world. As an emotional actress she was recognised as without equal. She acted male parts for a time with varying success, even the amputation of her right leg from the hip in 1911 did not end her career, and she continued acting until her death.

**Bernicia**, an ancient kingdom of the Angles in N Britain extending (according to tradition) from the valley of the Tyne to the Forth, and limited to the W. by the Strathclyde Britons, whose frontier was gradually contracted by the Anglian advance. The chief town of Bernicia was Bamborough. In the early 7th cent., the kingdom was united with its S neighbour, Deira, to form the kingdom of Northumbria (q v).

**Bernini, Giovanni Lorenzo** (1598-1680), Italian sculptor and architect, designed the colonnade of St Peter's, Rome. One of his works, a bust, may be seen in the Victoria and Albert Museum.

**Bernstein, Henry** (b 1876), French playwright of Jewish extraction, whose rather bitter and cruel dramas have had a good deal of success and not a little notoriety. *La Rafale* (1906) and *Israël* (1908) are typical. *Le Voleur* (1907), *Samson* (1909) and *L'Assaut* (1912) have been acted in London. *Après Moi* (1911) had to be withdrawn owing to opposition. For a time Guitry acted in Bernstein's plays. His subtle style was well suited to Bernstein's treatment of the "triangle" drama.

**Bernstorff, Johann, Count von** (1712-1772), Danish statesman, distinguished himself in the diplomatic service, and was later made Minister of Foreign Affairs, a post which he held for 20 years. During this

difficult period he acquired some fame as a negotiator. His main object was to add to Denmark the Gottorp portion of Holstein and first by preserving neutrality during the Seven Years War and then by alliance with France and later with Russia he succeeded in fulfilling this wish in 1763. His anti-Sweden alliance with Russia (1793) was his last great stroke. In 1800 he was dismissed from office and retired to Germany.

**Berry** ancient French province now a part of the departments of Cher and Indre. It was a Gothic possession in the 5th cent. and fell to various nobles until it went to Henry II of England as part of a marriage dowry. It was returned by treaty to France and lost its individuality at the Revolution.

**Berry** a succulent fruit (*qv*) containing usually several seeds each of which is covered by a hard protective coat to resist the digestive juices of any animal which may eat the fruit. To encourage animals to do this and so disperse the seeds berries are usually pleasant tasting. Well known examples are the gooseberry, currant, tomato and vegetable marrow. Blackberries, strawberries, raspberries etc. are not true berries in the botanical sense.

**Berry** Sir James Omer (b 1883) famous newspaper proprietor, part owner with his brother Lord Camrose (*qv*) of the *Daily Telegraph*. He has controlling interests in the *Daily Sketch* and several other newspapers and with his brother in Allied News papers Ltd, Amalgamated Press Ltd and Allied Northern Newspapers Ltd, the chief rival of the Rothermere interests for the provincial market.

**Bersaglieri** (BERSAGLIERI) a crack regiment of the Italian Army formed in 1836 for the Sardinian Piedmontese Army led by King Charles Albert. Intensively trained in scouting, rapid movement and sharpshooting (*bersagliers* = sharpshooters) they became well known from their black felt hats with black cock feather plumes.

They fought in the Crimea and in all Italian campaigns. They cover long distances rapidly by alternating a trot with a quick march. Since 1908 the whole regiment has been equipped with bicycles.

**Berserker** name of the 12 sons of Berserk (bearskin) a hero of Norse mythology. Later became a generic term for all recklessly courageous fighters.

**Berthollet, Claude Louis** (1748-1800) French chemist and the patronage of Napoleon he did research work on chlorine and was an associate of Lavoisier. The modern theory of chemical affinity may be said to derive from him.

**Bertillon, Alphonse** (1837-1914) inventor of the Bertillon system for the identification of criminals by means of anthropometry, the measurement of certain parts of the body, e.g. the head, fingers and feet. The system was replaced in England by fingerprint recording after 1900.

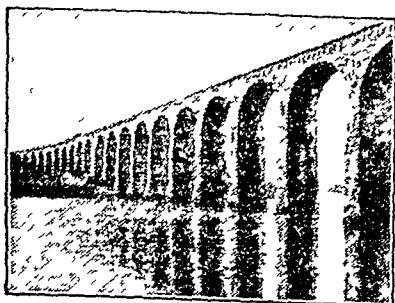
**Berwick, James Fitzjames, Duke of** (1640-1734) son of James II of England and Arabella, sister of the Duke of Marlborough, fought for his father at the battle of the Boyne (1690). Thenceforth he fought for France, being captured at Minden (1693) and for Spain when he won the battle of Almanza (1707) and captured Barcelona (1714). For this he received a Spanish dukedom and the governorship of Guienne.

**Berwickshire** one of the border counties of Scotland on the extreme E. Bounded S by Northumberland and Roxburghshire, N by Hadlington W by Edinburghshire and Roxburghshire and E by the North Sea. The surface from the high Lammermuir Hills in the N slopes steadily downwards towards the broad Tweed valley in the S. The Tweed forms most of the S boundary. The highest point is Sca Law (1750 ft). The principal rivers are the Tweed, Leader, Fye and Whiteadder. The valley of the Leader (Lauderdale) joins the Tweed valley. The coast is rocky and



the only good harbour is Eyemouth, St Abb's Head is the chief promontory. Agriculture is the principal occupation, and though the soil varies considerably, it is very rich in places, cereals and root crops are grown, and there are large areas devoted to sheep and cattle. The river fisheries are important, and shell fish and herring are caught along parts of the coast. Manufactures are not important, blankets and woollens are produced in a small way, and there is some stone quarrying.

There are a number of interesting ruins, including those of Coldingham Priory, Fast Castle, Cockburnspath Tower, and Dryburgh Abbey. The



Berwick Border Bridge

chief towns are Duns, the county town, Eyemouth, and Coldstream. Area, 460 sq m, pop 30,000.

Berwick-upon-Tweed, town and self-contained county in Northumberland, at the mouth of the Tweed. It has many famous historical associations, and the ancient ramparts are still standing, there are few other remains of the ancient city. It was a frequent centre of border warfare until the conquest of Scotland, when it was given a charter as a free borough. There are exports of grain, and coal, the coast fisheries and the salmon fisheries of the river are valuable. Pop (1931) 12,299.

Beryl, silicate of beryllium and aluminium. Usually found in green

hexagonal crystals in granites, gneisses and similar rocks. These crystals may be enormous, attaining a diameter of 3 ft and weighing 2 tons. Beryl is of commercial interest as a gem, especially when in the form of emerald, clear, and dark green, or aquamarine, light green. Golden beryl is a yellow variety. Beryls were quarried by the Egyptians as far back as 1600 B.C., and were alleged to give the wearer prophetic vision. They are now commonest in India, Siberia, and Brazil.

**Beryllium** For the characteristics of beryllium, see ELEMENTS. Beryllium or glucinum is a light metal chemically similar to aluminium. It occurs chiefly as the mineral beryl, which is a mixed silicate of aluminium and beryllium. Green beryl is known as emerald. The pure metal is obtained by electrolysis of the double fluoride of beryllium and potassium; it is used in the manufacture of several light alloys, and is gradually becoming of industrial importance. The alloy with copper finds application in the manufacture of certain musical instruments. Beryllium sulphate possesses a sweet taste, hence the alternative name of the element.

Berzelius, Jöns Jakob (1779-1848), Swedish chemist, was Professor at Stockholm and secretary to the Academy of Science there. From him the system of chemical symbols derives, and his work on atomic weights and on selenium (which he discovered), calcium, silicon, and tellurium was important.

Besançon [BÜSAHNS'ON], French town, capital of the Doubs department, lying on the R Doubs. The chief industries are watch- and clock-making, artificial silk, and paper. The cathedral has portions of 11th-cent work, and there are well-preserved Roman remains, including an arch, parts of a theatre, and an aqueduct. The university is several centuries old, and possesses a fine library. Pop (1931) 60,400.

Besant, Mrs. Anne (1847-1933),

British theosophist daughter of Wm Page Wood. In 1867 she married the Rev Frank Besant from whom she was separated in 1873. At first she was a disciple of Bradlaugh but later became a prominent theosophist and studied under Mme Blavatsky. She lived for long periods in India, became familiar with the culture of India and identified herself with Indian nationalist aspirations. She founded the Central Hindu College at Benares in 1898 and a girls' school in 1904. In 1907 she became president of the Theosophical Society and in 1917 of the Indian National Congress. From 1910 to 1927 she had as protégé Krishnamurti whom she regarded as a new Messiah but in 1930 he renounced the

Mastership attributed to him. Her once great influence waned considerably toward the end of her remarkable career and she had to deplore the hatred of one section of her brethren. Her publications include an autobiography *Reincarnation* (1892) and *Theosophy and the New Psychology* (1904).

**Besant, Sir Walter** (1838-1901) with James Rice wrote many popular novels in which Dickensian humour and social satire are apparent among them is the *Golden Butterfly* (1871). His own *All Sorts and Conditions of Men* (1882) led to the establishment of the People's Palace, London. His other works of a biographical and historical nature are less known but equally readable.

**Beskid Mountains**, a range of the Carpathians forming the border between Czechoslovakia and Poland. Several battles for the passes took place between German and Russian troops in the World War resulting finally in the defeat of the Russians.

**Bessarabia**, E. section of Rumania between the R. Dniester and Pruth and the Black Sea joined to Rumania by treaty April 11 1918. There are great variations of soil climate and racial characteristics in the two natural divisions of the territory. S of Bender the land is flat soil rich and

water scarce. In the Akkerman district there is a medley of races including well organised German and Swiss settlements.

A considerable amount of stock is raised and a large area of wheat maize and flax cultivated. Some tobacco is also grown. Culturally the people are rather backward in many parts of the country. In the capital Kishinev (Rum. *Chishinau*) (pop. (1930) 117 016) there is a large proportion of Jews. Several terrible pogroms occurred here under Tsarist Russian rule.

**Bessarabia's history** is one of alien rule. In 1474 it was taken by the Turks under Mohammed II. It was seized by the Russians in 1806 and was ceded to Russia by the Treaty of Bucharest 1812. Area 17 146 sq. m. pop. (1930) 2 865 506.

**Bessemer Converter** see IRON AND STEEL.

**Bestiary** a form of literature which had a great vogue in the Middle Ages. The Bestiaries were books concerning the supposed habits of animals. They were not concerned with scientific fact but with the legendary lore which served to give them a moral flavour. Examples are the *Bestiaire* of Philippe de Thaon (11th cent.) and a *Bestiaire d'Amour* by Richard de Lournival (13th cent.). There were many English translations of bestiaries and these were an important basis of Euphuism (q.v.).

**Betelgeuse** see CONSTELLATIONS.

**Betel Leaf**, the product of an Indian vine (*Piper betle*). The leaf 6 in. long is used by Eastern peoples as a narcotic. It is also used to envelop the betel nut (q.v.) with lime in order to provide a masticatory substance which discolours the teeth and mouth.

**Betel Nut**, the fruit of an Indian tree *Arecacatechu* about the size of a coconut used for chewing purposes with the betel leaf (q.v.).

**Bethel** (hou God) village 11 m. N. of the scene of Jacob's vision of the

Ark of the Covenant. It is in ruins to day and is called Beitin but was formerly known as Luz. Remains of churches are to be found here, one dating from the 6th cent. Pop c 500

Bethlehem, prosperous small town in Palestine, a few m S of Jerusalem. Wine-making is the chief industry. It was a garrison in the days of Saul, and was the birthplace of David. Its

Privy Councillor in 1901, and successfully opposed Bela Kun's communist revolution (1918). His achievements as Premier include the suspension of Hungarian reparations, arrangements for a loan from the League of Nations, and triumph in two general elections.

Bethmann-Hollweg, Theobald von (1856-1921), German politician, of a noble and wealthy family, held many high positions as Counsellor, Vice-



Bethlehem Bazaar

fame, however, is assured for all time as the traditional birthplace of Jesus Christ. It was taken from the Turks by British troops at the fall of Jerusalem on Dec 9, 1917. The Church of the Nativity is probably one of the oldest Christian churches in existence, and Mass is daily celebrated there by Armenians and Greeks. Pop (1931) 6800.

Bethlen, Stephen, Count (b 1874), Hungarian Premier 1921-1931. He became Member of Parliament and

Chancellor, and Prussian Minister, before becoming Imperial Secretary of State (1907) and Chancellor (1909). His action in 1911 in sending the *Panther* to Agadir brought Europe to the brink of war. In 1914 his reference to the British guarantee of Belgian neutrality as "a scrap of paper," and in 1917 his approval of indiscriminate submarine warfare gave him a reputation for belligerence, which he is said not to have merited. He resigned in 1917.

**Bethnal Green**, E. borough of London touching Hackney on the N and Stepney on the S. The Bethnal Green Museum a branch of the British Museum opened in 1872 is here Pop (1931) 108 178

**Béthune** [BE tŃv] French town in department Pas de Calais dating from the 11th cent. It was the scene of severe fighting in the World War being partially destroyed but is now largely rebuilt. Industries include coal mining oil earthenware casks tanning and salt refining Pop (19 6) 19 000

**Betony** (*Betonica Stachys arvensis*) a perennial wild plant (*Betonica officinalis*) the root of which was at one time used in medicine. Under the name of *Stachys* there are several garden kinds with purple or pink flowers. *Stachys media* has yellow flowers. Of dwarf stature flowering in late summer.

**Betterment** (law) increasing the value of property by making improvements. It is applied particularly to improvements made by a person not the owner e.g. a tenant public authority etc.

**Betterton**, Thomas (c. 1635-1710) famous English tragic actor especially in Shakespearean parts also known for his innovations in staging a subject which he studied in Paris. He was a son of one of Charles I's cooks.

**Betting** the act of staking a sum of money on some future contingency usually the result of a sporting contest. Organised betting on a large scale is now largely confined to horse and greyhound racing. The professional betting man or *bookmaker* came into existence to obviate the would-be backer's difficulty of finding someone to accept his bet. The bookmaker lays money against every horse in the race and generally receives enough to leave him with a considerable surplus after paying out to all winners. A horse may be backed either for a win or a *place* among the first three. The odds given depend on the desire

shown by the public to back a particular horse. Betting may take place *at the post* i.e. only when the numbers of the runners are announced just before a race or *wagering* may open weeks or months before the event *ante post betting*. The *Totalisator* (q.v.) or *pari mutuel* system in vogue on the Continent since 1816 was introduced into England in 19 4. Offsets are set up on the course: the backer hands his money to a clerk mentioning the number of the horse he wishes to back and whether for a place or win and receives a voucher in exchange. After the race the total sum paid in less a percentage is divided proportionately among the winners. See also GAMING and WAGERING.

**Beurre Noir** see SALCES

**Beuthen** BOI tŃv town in Prussian Silesia Germany S.E. of Breslau. Centre of mining industries of Upper Silesia. Chief products lead zinc machinery and chemicals. Pop. 9 300.

**Bevel**, a tool having a stock and blade at right angle like a square but adjustable to many angles. Used in bevelling (producing acute or obtuse angles) in carpentry and tonemasonry.

**Beverages**, **Alcoholic**. Certain foods may be fermented to make drinks containing alcohol. Cereals such as barley rice maize and rye will make beer whisky and grain fruits such as apples pears and grapes ferment to produce cider perry and various wines respectively. Rum is made from sugar cane and whisky sometimes from potatoes. Though the origin of many other drinks is similar they vary considerably in their final alcoholic strength. Beers, cider and perry are mild and contain between 3 and 10 per cent of alcohol. Cider and perry are usually slightly stronger than the beers. Some wines such as claret and hock are almost as mild as cider. Port and sherry have alcohol added containing sometimes as much as 24 per cent thereof. It was early discovered that a more powerful drink could be manufactured by heating

the fermented liquor in a vessel, and collecting the alcoholic fumes in another flask. These, on cooling, became a liquid of greater alcoholic strength than the original. This, simply, is the process which produces the distilled liquors or spirits—whisky, gin, brandy, and rum. Considerably less bulk of these drinks is required to produce intoxication, as they may contain up to 40 per cent of alcohol. Liqueurs are also distilled, but they are even more concentrated, having 35–55 per cent of alcohol, usually with some sugar added. (See WINES, SPIRITS, AND LIQUEURS, also COCKTAILS)

Alcohol in moderation has definite advantages under certain conditions. For the worker who returns home tired and worried, a little sherry or a mild cocktail will temporarily remove anxiety and help the gastric juices for the evening meal. A small amount of alcohol can be used by the body in the same way as fats or carbohydrates, giving heat and energy. As it is more quickly taken into the system than solid foods, it is sometimes of value in extreme cases of cold or hunger. Alcohol acts as a stimulant to the heart, and so is given in cases of emergency to restore the heart's action before medical attention can be obtained, but the dose may easily be overdone.

Indigestion and finally vomiting is caused by too much alcohol. The stomach cells which produce gastric juices will cease to act if soaked in alcohol.

**Beverley**, market town near Hull in E Riding of Yorkshire. Beverley was an important cloth-weaving centre in the 14th cent. Industries include agricultural tools, tanning, and brewing. It is famed for its Minster, a large church in the Early English, Decorated, and Perpendicular styles. Pop (1931) 14,011.

**Bewick, Thomas** (1753–1828), engraver, is best known for his woodcuts of animals and birds. *General History of Quadrupeds* (1790) and *History of British Birds* (1797) are his best works.

**Beyle, Henri Marie**, see STENDHAL.  
**Beza, Theodore** (1519–1605), French Protestant divine, after a gay youth, passed through a severe illness (1648), which caused a change in his outlook, and journeyed to Geneva, where he met Calvin. From 1559 to 1564 he was Professor of Theology there, and later succeeded Calvin. He wrote many theological works, but his histories were inaccurate. *Codex Bezae*, a MS of the New Testament in Greek, of doubtful origin, was presented by him to Cambridge University.

**Bezant** [BE'ZANT] (1) Originally a Byzantine coin issued both in gold and silver, the silver bezant being worth about one-tenth of the gold bezant, which varied in value between 10s and £1. These coins were widely used, being distributed through the medium of commerce and the Crusades. They were used in England in the early Middle Ages. (2) A heraldic term applied to gold discs in a coat of arms.

**Béziers**, town in department Hérault, France, on the R Orb and Canal du Midi. It lies in a wine-growing district, and possesses the ruins of a Roman arena and aqueduct. The town was destroyed in the early 13th cent, but there are many interesting mediæval monuments still to be seen, including a Gothic cathedral built in the 12th and 14th cents. Pop (1931) 71,527.

**Bézique** [BEZ-EEK'] (possibly from Spanish *besico*, "little kiss," in allusion to the meetings of queen and knave), a card game, usually for 2 players, played with 2 packs, from which all cards below 7 have been removed. Eight cards are dealt, 3, 2, 3, to each player, the remainder forming the "stock." Trumps are made by turning up the top card of the stock. The non-dealer leads first, and, subsequently, the winner of each trick. It is not necessary to follow suit in the first part of the game. The object is to "declare" various combinations of cards, viz *Marriage*, king and queen of a plain suit, scores 20, *Royal Marriage*, king and queen of

trumps 40 *Bézique* queen of spades and knave of diamonds 40 if spades or diamonds are trumps *bézique* is queen of clubs and knave of hearts *Double Bézique* all four *bézique* cards declared simultaneously 500 *Four Aces* 100 *Four Kings* 80 *Four Queens* 60 *Four Knaves* 40 *Sequence* ace ten king queen and knave of trumps 250 The *Seven of Trumps* may be declared or exchanged for the trump card and scores 10 if turned up 10 to dealer *Aces* and *Tens* in tricks score 10 each and the *Last Trick* scores 10 The ten ranks next after the ace After each trick each player draws a card from the top of the stock winner drawing first

A declaration may be made only after winning a trick, and before drawing from stock Declared cards are left face upwards on table and may subsequently be played When the stock is exhausted all declarations cease all cards are taken up and the last 8 tricks are played players must follow suit or (if void) trump if possible Game is 1000 (or any agreed total up to 10 000) Special *bézique* markers are used for scoring

For three and four handed *Bézique* 3 or 4 packs are used respectively *Triple Bézique* scores 1,000 and game is 2,000

In Polish *Bézique* game is not less than 2000 when a scoring card is played the trick winner places it face upwards on the table forming rows of aces kings queens knaves and trump tens (open cards) cards of the same denomination are placed overlapping Non scoring cards are turned face down and put on one side Every declaration must contain a card played to the trick last won Open cards may be used only for declaring Declarations continue during play of the last 8 tricks For *Bézique* 4 packs are used and 9 cards dealt in threes to each player A hand with no king queen or knave (*Carte Blanche*) scores 50 Trumps are made by the first *Sequence* or

*Warria* is declared Tricks are left face upwards till an ace or ten is played when the winner takes all played cards

Declared cards except *Carte Blanche* remain on the table Winner of the Last Trick scores 50 *Quadruple Bézique* scores 4500 One deal constitutes game the winner scoring 500 If the loser scores less than 1000 he is *rebiconed* and the winner adds the loser's score to his own and scores 1000 for game Fractions of 100 are neglected in scoring

**Bhagalpur** (1) A division in Bihar and Orissa British India extending across the Ganges from the Nepal frontier to the Chota Nagpur hills Area 18 613 sq m pop (1921) 7 886 900 (2) Central district in Behar province stretching across the banks of the Ganges Rice is mainly grown in the N but wheat maize and cotton are also produced The Ganges Kosi and Ghagri flow through the district Area 42,6 sq m pop (1921) 2 034 000 (3) Chief town of the Bhagalpur district situated on the Ganges Agricultural produce and silk weaving are the main industries Pop (1931) 83 847

**Bhagavadgita**, a religious poem which forms part of one of the great Hindu epics It is pantheistic in its teaching and is one of the most important of Hindu religious documents See also HINDUISM

**Bhamo**, district and town in the N E of Burma on the Chinese frontier The town is at the highest navigable point of Irrawaddy basin and is the terminus of the great caravan route from India and Burma by which jade especially is brought to China The natives are Shans Chinese and Indians Area 4500 sq m pop district 81 000 town 8000

**Bharatpur** (or *Bharatpore*) native State of N E Rajputana watered by the Banganga R Cotton and iron-ore are the chief products The State acquired importance during the collapse of the Mughal Empire uniting with the Mahratta confederacy in 1603 Lord

Lake was repulsed in an attack on the capital, which fell, however, to the British during the war of 1825-6. The State came directly under British administration in 1853, owing to the minority of one of the Jat dynasty of Suraj Mall, whose descendants still rule. The capital is the city of Bharatpur (pop c 31,000). Area c 1980 sq m, pop c 500,000.

**Bhopal:** (1) A hilly State in Central India Agency principal Mohammedan State in Central India, founded 1723 by Dost Mohammed Khan. For over 150 years has been loyal to Britain. Area, 6902 sq m, pop 729,700. (2) Capital city of Bhopal State. Among the industries may be mentioned textiles and native jewellery. Pop 46,000.

**Bhutan,** an independent State under British protection, in the E Himalayas. To the N lies Tibet, and on the S British India. Length, 190 m, breadth, 90 m, area, 18,000 sq m. A mountainous and picturesque country of extensive forests and deep valleys, irrigated by tributaries of the Brahmaputra. The principal mountain ranges are Masong-Chung-Dong, Dokyongla, Black Mountains, and Tawang. Climate varies from tropical heat to intense cold. Fauna include the elephant, leopard, tiger, cheetah, also the horses for which Bhutan is famed.

Britain's relations with the country began in 1772, when Warren Hastings sent a force to drive the Bhutanese from Cooch Behar, which they had invaded. In 1774 a treaty was concluded between the E India Company and Bhutan, but for a number of years following the Bhutanese plundered and carried away British subjects. Envoys sent to negotiate were unsuccessful. In 1910, however, a treaty was concluded between the two Governments, and since then relations have been satisfactory. Nominally the Bhutanese are Buddhists.

Chief productions are Indian corn, rice, millet, wax, cloth, and silk. The people, who are skilled craftsmen in

metal-work, make guns and swords. Pop (1933) c 300,000. The winter capital is Punaka, and the summer capital Tashi chöi-zong.

**Bialystok** [BYAWIST'OK], Polish town and department. The town is a railway centre, with some textile industries. It has a large Jewish population. The county is adjacent to E Prussia, agriculture is the principal occupation. Cereals (oats, etc.) in the North are the chief crops. Area of department, 12,400 sq m; pop (1931) department, 1,640,400, town, 91,300.

**Biarritz,** fashionable French seaside resort on the Atlantic, near Bayonne and the Spanish frontier. The town is built along a rocky cliff, and was made popular by the Empress Eugénie and King Edward VII. Pop 21,000.

**Bible,** name, derived from a Greek word meaning *the Books*, given to the collection of writings on which Christian doctrine is based. The Bible is divided into two sections, the Old and New Testaments (*q v*), and is acknowledged by the Christian Church as a whole as divinely inspired. The Roman Church admits certain books to which the Protestant Churches ascribe only a lesser degree of authority (*see* APOCRYPHA). The Church affirms that all the books which it includes in the Bible are inspired by God, and are thus a final source of religious doctrine. This view is accepted by Protestants and Catholics alike, though the latter affirm that the tradition and teaching of the Church is a parallel authority, and that she alone has the power to interpret the Scriptures. The Protestant view is that the Scriptures are the only doctrinal authority, and the individual conscience has the power and duty to interpret them, though the tendency of many modern Protestants is to adopt the view that large parts of the Bible are merely allegorical and versions of traditional history, and that while much of its teaching was inspired by God, it is not verbally infallible.

*Of English versions of the Scriptures*

in manuscript the first of importance are several Anglo-Saxon translations of the Gospels dating from the 10th cent. These include the *Lisdisfarne Gospels* the *Rushworth Version* and the *West Saxon Gospels*. Not until the 14th cent. was any further progress made with vernacular translation. In English but at this period several versions of the Psalter and of some New Testament Books were made. To the 14th cent. also belong the first complete versions of the Bible namely the early and late versions associated with the name of Wyclif (q.v.).

The earliest English printed Bible was that of William Tyndale (q.t.). His version was first printed part by part in various German towns and in 1534 a portion of his version was the first that was ever printed in England. But Tyndale's great as was its merit was not a complete version of the Bible. This was provided for the first time by Miles Coverdale (q.t.) and was printed in 1535 out of England. In this version the non-canonical books were for the first time placed at the end as the *Apocrypha*. *Matthew's Bible* appeared in 1537 and its second edition (1538) was the first complete English Bible to be printed in England. It was probably the work of John Rogers who used the pseudonym *Thomas Mattheus*. The *Great Bible* of 1539 was printed under the direction of Coverdale and was sponsored by Archbishop Cranmer and Thomas Cromwell. In 1560 appeared the *Crimm Bible* which is known as the *Breeches Bible* from its translation of Gen. iii. (Adam and Eve made themselves breeches). The *Bishops Bible* was published in 1568 as an authorised version based on the *Great Bible* to combat the unauthorised Geneva Bible. The *Doanay Bible* (1582-1610) was the official English version made for Roman Catholics.

The *Authorised Version* of 1611 was a revision of the *Bishops Bible* and drew largely upon earlier versions such as Tyndale's. Its scholarship was the finest that could be procured and the

result was as accurate a version of the then known originals as could have been made. The *Revised Version* (New Testament 1881 Old Testament 1884 Apocrypha 1895) was the result of a desire to produce a still more accurate translation based on further knowledge of the earliest originals and the general advance of the science of textual criticism. The last two together comprise the Bible known to Protestant England though the latter in spite of the value of its greater accuracy to the theological student cannot compare in literary worth with the former. There have been several versions in modern English published both in England and in America.

Both as monuments of English literature in themselves and for their influence upon the development of English prose the various versions of the Bible particularly the Authorised Version are of extreme importance. The Authorised Version is stamped throughout with the literary genius of the age in which it was produced. The language is simple forceful and direct and in parts touches the heights of poetical expression. The very felicitous clothing of Hebrew thought in a perfectly fitting English dress brought to the English language an incalculable number of happily turned expressions by which the language and literature is infinitely the richer. See J. H. Gardiner's *The Bible as English Literature* (1906).

**Bible Christians**, a religious sect formed in Cornwall in the early 18th cent. an offshoot of the Methodist. They were later incorporated into the United Methodist Church and subsequently (1871) into the Methodist Church.

**Bible Societies**, formed for the purpose of circulating the Holy Scriptures have been formed in many countries. The most important is the British and Foreign Bible Society (1804) a non-sectarian society with widespread activities one of the chief of which is the translation of the Bible.



or of portions of it, into many hundreds of languages

**Biblia Pauperum**, "Bible of the Poor," a book composed of pictures of the principal events recorded in the Old and New Testaments with notes added. This book was widely used in the Middle Ages, especially by mendicant preachers

**Bibliography** [BIBLIO'GRÁFI], a term now applied to writing *about* books, though originally it meant the writing of books. A bibliography is in effect, a systematised list of the books of some author or authors, or of books dealing with a certain subject, giving all useful particulars concerning each of such books, as the title, author, publisher, size, binding, printing, date, illustrations, and some indication of the nature of its contents. A general bibliography of all books is obviously impracticable, and the nearest approach to such is, perhaps the *Subject Index* of the British Museum Library (Fortescue). Another, and more accessible, work is W. S. Sonnenschein's *The Best Books* issued in six volumes.

**Bichat, Marie François** (1771-1802) French physiologist, founded the study of general anatomy, on which he published several important works.

**Bickerstaffe, Isaac** (c. 1735-c. 1812), English dramatist, had a chequered career, and is thought to have died in great poverty. Among his plays and musical farces were *He Would if He Could* and *Love in a Village*. The name *Isaac Bickerstaff* was also used as a *nom de plume* by Swift (in his practical joke on an almanac-maker and astrologer of the same name) and by Steele.

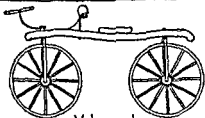
**Bicycle** The bicycle, a vehicle which travels upon two wheels set one before the other in the same line, arose from three inventions: firstly, pedal-propulsion by the rider, secondly, running on a single track, rendered possible by the stability due to pivoting of the front wheel, and thirdly, the pneumatic tyre, which greatly reduces the energy required to drive it on an ordinary road. Cars propelled by

persons sitting in them are probably very old, but in the 18th cent. they were experimented with on a considerable scale. In the meantime, the single-track idea was invented by Carl Drais, c. 1816, and the machine was called the *velocipede*. This consisted of a pair of wheels about the same size, with a seat for the rider between them, he propelled the contraption by touching the ground with his feet. This led to the discovery that such an arrangement could be stable without the necessity of the rider touching the ground, especially when the axis around which the front wheel is pivoted is suitably inclined, and in c. 1840 the first true bicycle, driven by a parallel foot motion, was made by Macmillan in Dumfries, Scotland. In England they were appropriately known as "boneshakers." In 1865, Lallement, in Paris, applied the crank drive to the front wheel, and his machines became very popular. Further improvements included the use of solid rubber, instead of iron, tyres, and of wheels with wire, instead of wooden, spokes, which considerably lightened the machine.

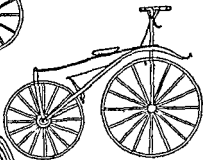
These improvements were so great that the diameter of the front wheel could be increased to the maximum given by the length of the rider's legs, without rendering the "gear," that is to say, the distance travelled for one revolution of the pedal, too great for comfort. Even to-day, the gear of a bicycle is stated in terms of the diameter of the driving wheel of an old "penny-farthing" or "ordinary" bicycle travelling the same distance for one revolution of the crank.

The ordinary bicycle was, however, rather unsafe, since the weight of the rider had only to move forward very slightly to over-balance altogether. In the eighties the "safety" bicycle was introduced, having two equal or nearly equal wheels. The rider sits with his weight mainly over the rear wheel, to which the drive from the cranks is transmitted by a chain.

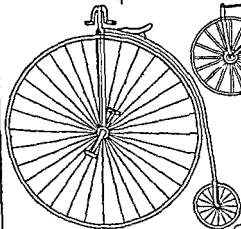
# BICYCLES



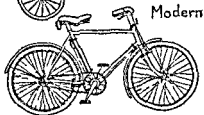
Velocipede



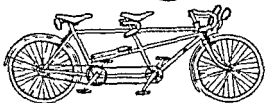
Boneshaker



Penny Farthing

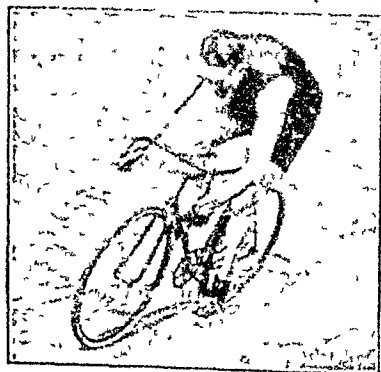


Modern



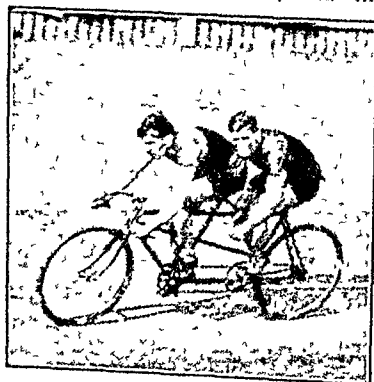
Tandem

running over cogged wheels. This enables any desired gear ratio to be employed. A further improvement consists in introducing into the rear hub a variable gear on the epicyclo-



Cycle racing

system (see EPICYCLIC GLAR). The pneumatic tyre (q1), invented by Thompson in 1813, and re-invented by Dunlop in 1880 was applied to the bicycle a few years later, and the



Cycling Tandem.

machine as it is made to-day was complete.

Cycle-racing was at one time very popular, and many tracks were built, but the sport declined in public favour

in England, though on the Continent it is still popular. Racing in England is controlled by the *National Cyclists' Union*, formed in 1878, which holds annual championships. The *Cyclist's Tourist Club*, formed in the same year, has done much to encourage cycling by publishing road maps, recommending hotels, and erecting warning signs at dangerous spots. The road from London to John o' Gaunt (900 m) of 2 days 13 hours 1 minute was made by H. Roskiter. The record for 1 m. (motor paced) seconds, by W. T. Hall. The records for 5, 10, 20, 50, and 100 metres are all held by L. Vander who also holds the record for distance covered in 1 hour, viz. 76 m. 30 s.

Biddle, John (1615-1682) the English Unitarian. He was imprisoned and banished for publications attacking the Trinity. Under a general amnesty in 1652 he returned to London, and resumed his teachings, led to his renewed imprisonment and died in gaol of fever.

Bidpai, a fictitious Brahmin philosopher, legendary author of *The Advice of Bidpai*, or *Pitpay*, which contains advice to rulers, in the form of animal stories, on the conduct of kingdoms. They have been translated into every important language; a Latin translation of a Hebrew version by Rabbi Joel Sir Thomas. turned them into English in 1657.

Biel, Swiss industrial town at NE end of Lake Biel. The manufactures are watches, and race accessories. Biel dates from c. 12th cent. It fell to the French during the Revolutionary Wars, and attached to Berne in 1815 (1930) 37,700.

Bielefeld, town, Westphalia, Prussia. A busy manufacturing centre, chiefly of linen, which was introduced by Dutch settlers in the 16th cent. much-restored castle stands on Sparrenberg, and the Marienkl. (13th-cent Gothic) has a fine piece. Pop (1925) 114,180.

Bienna, see BIEL.

**Biennial Plants** Briefly these have a 3 year cycle in which to grow from seed mature flower and die. The seeds are usually sown from March to May and the seedlings grown on well cultivated soil much after the manner of vegetable treatment. In the autumn or following spring they are transplanted to the border where they begin to flower in April onwards. In some cases there will appear a second crop of blossoms if all the stems that have borne flowers are cut down and in other cases the plants will continue to bloom the following year whilst some may not flower the first season but continue to grow into enormous size with a corresponding wealth of blossom the second season. Biennials include Canterbury Bells Foxgloves Honesty Sweet Williams Evening Primroses Scabious Pinks. Many annual and perennial plants are greatly improved by being treated as biennial e.g. hardy annuals sown in late summer make huge plants by the following year and perennials sown in July bloom the next season. Examples Godetia Larkspurs Cornflowers amongst annuals Antirrhinum Hollyhocks Chrysanthemums amongst perennials. There are hardy half hardy and greenhouse biennials.

**Bigamy (law)** the crime of marrying a second wife or husband during the life of the first. It is not a crime to marry again in the honest and reasonable belief that the first spouse is dead or when the first spouse has been continuously absent for the previous 7 years and has not been known to be alive during that time or when the first marriage has been dissolved by divorce or decree of nullity by any court of competent jurisdiction.

**Big-game Hunting** see SHOOTING.

**Bignonia (Leona Trumpet Flower)** a group of perennial tropical climbers with large trumpet-shaped flowers and clinging tendrils suited to growing on walls or trellises out of doors or under glass—the latter chiefly trencoring and in

and careful culture until well established. The generally grown kinds include *Bignonia radicans* and *B. grandiflora* both orange scarlet and may be grown outdoors on a S wall. *B. Smithii* an autumn flowering green house kind which blossoms in autumn from seeds sown in early spring (orange yellow red flowers).

**Bihar and Orissa** (1) Province of E. India formed in 1912 from five divisions of the old province of Bengal. The capital is Patna where there is a college. A total of 4 470 090 acres is actually under cultivation drained by the Ganges and the Mahanadi growing wheat maize rice sugar cane and tobacco. There are 3000 sq m of forests. The mineral wealth is varied and of particular importance to the province—coal iron copper and mica. At Jamshedpur the Tata iron and steel works is the outstanding industrial centre. After changing rulers many times the territory was formally ceded to England by the treaty of Allahabad 1765. Area 111 702 sq m pop (1931) 37 955 000.

( ) Bihar a town 40 m distant from Patna has a pop (1931) of 36 700 and was once the capital of the ancient kingdom of Magadha regarded as the cradle of Buddhism.

**Bihari Language** spoken in the province of Bihar belongs to the E group of Indo European Language (q.v.) but has more affinities with the W group than most other languages of its group. It is divided into the Maithili Magahi and Bhojpuri dialects the first two of which have a considerable folk literature.

**Bijapur** Indian city in the S. of Bombay. The ruins of the old town once the capital of the kingdom of Bijapur are among the most impressive in the country. The great citadel the Temples the complex and ingenious water system and the huge tomb of Sultan Mohammed Adil Shah who conquered the country and added it to the Delhi empire are of archaeological value. The modern district of

the execution of laws by regal authority without consent of Parliament is illegal, (2) that the pretended power of dispensing with laws or the execution of laws by regal authority as it has been assumed and exercised of late, without consent of Parliament, is illegal, (3) that the levying of money for or to the use of the Crown by pretence of prerogative without grant of Parliament for longer time or in other manner than the same is or shall be granted is illegal, (4) that it is the right of the subject to petition the King, and all commitments and prosecutions for such petitioning are illegal, (5) that the raising or keeping a standing army within the kingdom in time of peace, unless it be with consent of Parliament, is against law, (6) that subjects who are Protestants may have arms for their defence suitable to their conditions and as allowed by law, (7) that election of Members of Parliament ought to be free, (8) that freedom of speech and debates or proceedings in Parliament ought not to be impeached or questioned in any court or place out of Parliament, (9) that excessive bail ought not to be required nor excessive fines imposed nor cruel or unusual punishment inflicted, (10) that for redress of all grievances and for the amending, strengthening, and preserving of the laws, Parliament ought to be held frequently, and a few minor provisions. The Act does not create new law, but is merely declaratory of the old.

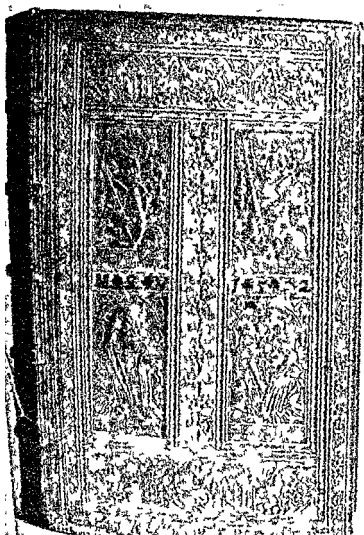
**Bill of Sale.** an assignment by deed of chattels, whether absolute or by way of mortgage, of which the most important feature is that it operates without actual delivery of the goods, thus clearly might, and often did, produce unpleasant results, for such a transaction was often used fraudulently to defeat creditors endeavouring to take the grantor's property in execution. To meet such difficulties, the Bills of Sale Act, 1874, and subsequent Acts established the principle of registration for such bills. Absolute bills must be attested by a solicitor,

must state the consideration paid, and must be registered within 7 days, and the effect of non-compliance is that the bill is void against the trustee in bankruptcy and execution creditors of the grantor as regards property remaining in his apparent possession. A mortgage bill must be in a certain statutory form, to which an inventory must be annexed, attested, and registered, it must state the consideration, which may not be less than £30, and the mortgagor must be the true owner of the property at the time of the mortgage.

**Bills of Mortality,** returns of the deaths which occur within a certain district. They began to be made in London after an outbreak of plague in 1592, though there are a few earlier instances, and from 1603 on, after another outbreak, were made regularly, week by week, with a view to giving the authorities and inhabitants full information as to the increases or decreases in the number of deaths. In 1836 they were superseded by the Registrar-General's returns under the Births and Deaths Registration Act.

**Bimetallism,** the use by a country of both gold and silver as the standard of value of the currency. Most countries have both gold and silver coins in circulation (or silver and notes convertible into gold), but that does not mean that more than one metal acts as the standard of value. In the United Kingdom gold is normally the standard of value, while silver coins, of far less intrinsic than face value, are merely *tokens* measuring an arbitrary fraction of the gold unit.

Because when two metals are used a ratio must be fixed between them, such as 15 to 1, or 16 to 1 (if any weight of gold is taken as worth 15 or 16 times as much as the same weight of silver), and because the world supply of the two metals depends on varying conditions, the market price of the metals may vary, and one may become more or less valuable in relation to the other. When the variation in market value is away from the fixed ratio lasts for any





BOTTICELLI "LA PRIMAVERA"

of time the overvalued metal  
and to drive the undervalued  
out of circulation (*see* GRESHAM'S

inconveniences resulting from  
difficulty of the fixed ratio and  
g market values of gold and  
caused most countries to adopt  
the standard in the 19th cent  
*see* GOLD STANDARD

*ding see* NEEDLEWORK

*weed*, a troublesome weed which  
is much food and water from the  
and twists around other plants  
ling them and cutting off the

The flowers of several species  
autiful but if brought into the  
the plant is never eradicated  
*See*, Sir Alexander (1839-1917)  
er worked in Wales India and  
nd As Engineer in Chief to the  
he was responsible for the  
wall Tunnel

omial Theorem, *see* ALGEBRA  
yon, Laurence (b 1889) winner of  
ewdigate prize (1890) 1932-3  
r of Prints and Drawings in the  
h Museum is an esteemed au  
y on eastern art He is more  
y known however for his poems  
ection of which was published in

and for his plays in blank verse  
*ris and Oenone* (1906) and *Boadicea*  
(1915)

Biochemistry is concerned with all  
chemical processes occurring in  
ing organisms with their constitu  
a and with their reaction to  
emical elements and compounds  
scope is therefore very extensive  
d includes the consideration of the  
ture of protoplasm the physico-  
mical basis of all plant and animal  
ls (*qv*) the synthetic processes  
thin cells foods their digestion  
iboration and decomposition the  
duction of energy by chemical  
anges within the organism the  
ect of hormones (*qv*) on cells  
stems and individuals chemothera  
y) chemotherapy the use of anti  
ptics (*qv*) inside the organism to cure  
check infective diseases immunity  
is to the production of antibodies

when antigens are introduced into the  
body and even with the nature of life  
itself

*Protoplasm* has been described by  
various observers as fibrillar granular  
reticular and foam like and the  
correctness of these descriptions has  
been extensively called in question  
It is now however generally accepted  
that protoplasm is a complex colloidal  
system with water as a dispersion  
medium in which are different types of  
colloids (*qv*) some soluble in water  
others remaining suspended Small  
drops of emulsified fat and other  
minute particles are present some of  
them so small that they can be detected  
only with an ultramicroscope Since  
constant changes are taking place in  
active living cells the different theories  
of the structure of protoplasm may be  
accounted for by differences in a com  
plex colloidal system The different  
structures of dead cells may be due to  
the reaction between the protoplasm  
and the reagents used to kill it

Active protoplasm is a translucent  
viscous liquid Its viscosity varies  
being dependent on the constitution of  
the system and on temperature Rise  
in temperature decreases the viscosity  
and eventually causes coagulation

Like all colloids protoplasm has the  
property of adsorption (*qv*) Brownian  
movement (*qv*) and is semi permeable  
The passage of food solutions into cells  
is due to this semi permeability which  
in most cases allows the transference  
of water and dissolved materials from a  
dilute solution or from a more  
hydrated colloidal system into a  
stronger solution or less hydrated  
system respectively The passage of  
a solution through the membrane into a  
stronger solution is described as  
osmosis and the difference in pressure  
between the solutions on either side of  
the membrane is the osmotic pressure  
There are divergent views on the forces  
controlling osmosis through the proto  
plasmic membrane Some biologists  
think the controlling agent is a vital  
force others consider the formation  
and action of the plasma membrane to



be essentially bound up with the nature of protoplasm. The membrane consists of fats, soaps and lipides included in a mesh of proteins. Water and substances dissolved in it pass through the protein fibres, the remaining transferable materials pass through the other parts of the membrane. In this way food passes from the bloodstream into cells of animals, from the soil into roots, and is transferred from cell to cell.

Chemical analysis shows protoplasm to consist of proteins, some very complex and unstable, and different from any yet synthesised, containing phosphorus, albumins, enzymes, and other organic compounds containing nitrogen, carbohydrates, lipides, mineral salts, and a small percentage of other constituents. An ultimate analysis shows that oxygen, hydrogen, nitrogen, chlorine, carbon, phosphorus, sulphur, are non-metallic elements always present in association with the metals calcium, magnesium, iron, potassium and sodium. Individual organisms may contain traces of other elements, but such additional ones do not seem to be essential.

*Plants as Synthetic Chemists* Green plants have the advantage over animals of being able to synthesise from carbon dioxide, water, and inorganic salts, the carbohydrates, fats, proteins, and vitamins that animals need as food. The production of carbohydrates by the synthesis of carbon dioxide and water, with the elimination of oxygen, has been indisputably proved to occur, in sunlight, in cells containing chlorophyll, and is called photosynthesis or carbon assimilation. This is a process of fundamental importance to both animals and plants, for the oxygen liberated is available for the oxidation of food, with the consequent liberation of energy essential to all organisms.

The synthesis of fats and proteins is dependent on that of carbohydrates, but the mode of effecting these syntheses in the plant is not definitely proved. In the laboratory sugar has

been synthesised from carbon dioxide and water, with the formation of formaldehyde as an intermediate product. The production of formaldehyde in plants, however, was questioned until 1926, when its presence in minute quantities was conclusively demonstrated in green leaves during active photosynthesis.

*Pigments* The chlorophyll of plants is a mixture of chlorophyll *a*, soluble in petroleum ether, and chlorophyll *b*, soluble in methyl alcohol. The former is  $(C_{55}H_{72}O_6N_4Mg)O$  and the latter  $(C_{55}H_{72}O_6N_4Mg)CO_2$ . Chlorophyll and the red pigment hæmin, in the hæmoglobin of red-blooded animals and the hæmocyanin of blue-blooded animals, such as the snail and crab, possess a similar structural unit. The formula most recently assigned to hæmin is  $C_{34}H_{32}N_4O_6Fe$ . In hæmocyanin, copper takes the place of iron.

Accompanying chlorophyll are two other complex pigments, carotin, varying in solution from yellow, through orange to blood-red, according to the solvent used, and xanthophyll, which seems to be an oxidation product of carotin. Although the latter, from the evidence available as a result of experiments on leghorn fowls, is not essential either to their health or fertility, it is commonly present with xanthophyll in the yolk of eggs and in the fatty tissues of the birds, causing the rich yellow colour. Carotin is also found in butter and milk.

The fact that chlorophyll, carotin, and xanthophyll form different absorption bands in the spectrum (*qv*) was used by the Air Force in the World War to distinguish foliage from green paint used as a camouflage. The latter, viewed through a special colour filter, appeared green, whereas the foliage appeared purplish or orange-red, owing to the exclusion of the green rays of the chlorophyll.

*Respiration and Muscular Action* In animals, hæmoglobin functions as a carrier of oxygen. The iron present combines loosely with the inhaled oxygen, forming oxyhæmoglobin, a

bright red unstable compound which readily parts with oxygen to tissues having a lower oxygen pressure. As a result of the oxidation of the tissues themselves or of foods stored in them energy is liberated, carbon dioxide is produced and a dark red compound, carboxyhaemoglobin, is formed. This is oxidised in the lungs and in the gills of aquatic animals with the elimination of carbon dioxide.

Muscular and mental fatigue are frequently due to deficiency of oxygen. In muscle the carbohydrate glycogen undergoes chemical changes resulting in the formation of lactic acid, increasing the hydrogen ion concentration ( $q\pm$ ) of the cells. Consequently water is absorbed from the fluid surrounding the muscle fibres which shorten and increase in girth. This reaction occurs when an impulse passes from nerve to muscle; when the impulse ceases, a small quantity of the lactic acid is further oxidised to carbon dioxide eventually respired and water, but most is again synthesised with the aid of oxygen into glycogen. The hydrogen ion concentration is therefore decreased, less water can be held by the cell and excess is exuded. As a result the muscle relaxes. The whole process may take place very rapidly, as indeed it must when any series of quick movements is executed. For the recovery of the muscle oxygen is absolutely essential, but the chemical changes causing contraction and those occurring in connection with haemoglobin and respiration are due to the activity of enzymes ( $qv$ ).

Enzymes are compounds produced both by plants and animals and acting as catalysts. Their structure and mode of action are still unknown for they are produced in such minute quantities that the preparation of a pure enzyme is extremely difficult and the majority of biochemists have so far been unable to support claims with regard to the isolation and nature of the constitution of certain enzymes.

The first enzyme to be discovered

was found in germinating seeds in 1833 and named diastase. The term enzyme meaning literally in leaven was not introduced until 1878 when Pasteur ( $qt$ ) recognised that the action of diastase was similar to that of catalysts produced by yeast ( $qv$ ). Since diastase effects the conversion of starch into sugar it is now included as an amylase with other enzymes hydrolysing starch.

The conversion of starch into a soluble sugar makes it available either for the immediate use of the plant or for transference from leaves where it is manufactured to tissues where it is to be stored. Amylases in saliva and intestinal secretions make possible the digestion of starch in the higher animals.

Amylases, proteases and lipases are all examples of hydrolysing enzymes effecting chemical change by the addition of water to the original compound. Certain enzymes however initiate destructive changes involving the breaking down of compounds without preliminary hydrolysis. The best known of these desmolysing enzymes is that found in yeast, zymase, which induces the fermentation ( $qv$ ) of hexose sugars into alcohol and other products.

It was originally believed that enzymes could act only in living cells and organs but many of them have now been extracted and have activated their specific changes under their appropriate conditions in the laboratory.

Considerable biochemistry has been done in connection with digestion, bacteriology, metabolism and the treatment of diseases ( $qq\pm$ ).

BOOKS OF REFERENCE: Gortner R. A. *Origins of Biochemistry*; Cobb T. C. *The Origins of Internal Secretion*.

Biogenesis (*from*  $\beta\iota\omicron\gamma\epsilon\eta\epsilon\varsigma$ ) the origin of living organisms from others preceding them. This doctrine is opposed to that of abiogenesis or spontaneous generation, a theory that had many supporters until the end of the 19th cent. The appearance of

maggots in meat, bacteria and yeast in fermenting sugar solutions, and worms in water containing horse-hair, was adduced as evidence of spontaneous creation, and it was not until after Pasteur (*qv*) showed that no fermentation or putrefaction could occur on sterilised media enclosed in sterilised vessels, that many people abandoned the theory

Although biogenesis is now generally accepted as the mode of origin of all known forms of life, it is thought by some scientists that, since there is evidence that ultra-microscopic filterable viruses are living organisms, there may be no real border-line between living and non-living material, and that forms recognisable as living were evolved by the synthesis of smaller particles. This conception of abiogenesis is on a different plane from that commonly known as the theory of spontaneous generation, and raises the problem of the vitalist and mechanistic conceptions of life. See also BACTERIOLOGY, BIOLOGY, EMBRYOLOGY, EVOLUTION

**Biography**, the form of literature which consists of the account of some individual's life. In every early literature, the poems or stories relating the exploits of some hero are largely biographical.

In classical literature, the salient biographical works are Xenophon's *Memorabilia* of Socrates, Plutarch's *Parallel Lives of the Greeks and Romans*, Cornelius Nepos's *De Viris Illustribus*, and Suetonius's *Lives of the first twelve Roman Emperors*. Later came St Jerome's *Lives of the Fathers*, certain biographies by Bede and other early English writers, and in 1640, the first of the series of Izaak Walton's (*qv*) *Lives*. These last are a definite milestone in the course of the development of modern biography. Pepys's *Diary*, belongs rather to autobiography (*qv*) but in the 18th cent appeared two more notable works in this field. Johnson's *Life of the Poets* and Burney's *Life of Dr Johnson*. To English readers the latter is probably the

best-known of all biographies. Among the great 19th-cent biographies the following are notable: Southey's *Life of Nelson*, Lockhart's *Life of Scott*, Trevelyan's *Lives of Macaulay and Charles James Fox*, Carlyle's *Frederick the Great*, and Moore's *Life of Byron*. Sir Sidney Lee's *Life of Shakespeare*, though now largely discredited, is a monument of patient research.

The number of biographies has steadily grown, and this has become one of the most popular forms of literature. All sorts of men and women have been made the more or less worthy subjects of more or less competent biographers, and among the great number of such works that have appeared in recent times it should not be invidious to select, as representative of the best, Lytton Strachey's *Queen Victoria* (1921), Sir Sidney Lee's *Edward VII* (1925-6), and Winston Churchill's *Life of Lord Randolph Churchill*.

Many biographical dictionaries have been published from the 16th cent. onwards, the most important of these is the *British Dictionary of National Biography* (the *D.N.B.*). This was begun in 1882, with Leslie Stephen as editor, and continued by Sir Sidney Lee. The original 63 volumes have been supplemented at various times by 6 additional volumes, which bring the work down to 1921. *Who's Who* is a reference book giving particulars of living celebrities, and has its equivalent in nearly every country.

**Biology**, literally the study of life, but what life is remains to be discovered. Meanwhile, biology is concerned with living things—their form, structure, and diverse manifestations of life. Living things feed, grow, respire, are irritable (i.e. sensitive to external influences), and are capable of reproducing themselves. No single manifestation is sufficient, with certainty, to characterise a living organism, for some inanimate things will be found to exhibit similar manifestations. For instance, crystals feed and grow; carbon combines with oxygen to yield

carbon dioxide and energy a process analogous to breathing and movements of a selenium cell may be activated by light

**Divisions of Biology** Since plants and animals present at first sight such striking differences they were considered separately under botany (*q v*) the study of plants and zoology (*q v*) the study of animals. Not till 180- was the term biology suggested by Trevisan and independently by Lamarck and the two sciences formerly regarded as independent are now recognised as the two main divisions of biology. Both the sciences have many features in common and consequently are divided into similar branches.

The study of the general form of plants and animals is *morphology*, which is subdivided into external morphology concerned with external shape and structure and internal morphology or *anatomy* (*q v*) dealing with the various systems organs tissues (*q v*) and cells (*q v*) and their arrangement within the organism. Cells are of such diverse structure that the particular study of their form is included in histology and of their structure in cytology. Anatomy particularly that of the human being is of especial importance in surgery (*q v*).

Consideration of anatomy raises the question of the origin and mode of differentiation of cells tissues organs and systems and necessitates a study of *embryology* (*q v*) the development of the organism from the egg. The complete development of an individual is described as *ontogeny* (*q v*). Studies of development show that structures which judged merely from a consideration of their external morphology would be regarded as similar may have very diverse origins. Embryology and ontogeny have thus demonstrated the difference between analogy and homology (*q v*). The latter was recognised as being of primary importance in the studies of comparative anatomy and of *evolution* (*q v*) the process of progressive change in living organisms.

Arising from the study of morphology is the consideration of the relation of form to function and *physiology* (*q v*) is the branch of biology dealing with the particular functions of cells and organs. Physiological anatomy shows the relationship between the forms of these structures and their functions. Tissue culture (*q v*) a recent development of physiology is in which cells are grown in the laboratory under carefully controlled conditions affording valuable information with regard to the reactions of cells to certain chemical and physical agencies and to their behaviour in particular diseases. The respiration, nutrition, and reactions of cells and organisms involve considerable chemical and physical changes. Biochemistry (*q v*) and physics comparatively recent developments of biology have made considerable progress since the end of the 19th cent.

Investigations in *ontogeny* revealed the connection between the development of various organisms and suggested that they had a common ancestor very remote. The study of the development of organisms is *phylogeny* (*q v*) dependent on palaeontology (*q v*) the study of ancient forms of life and of great importance in theories of evolution. In this connection Huxley's *theory of descent* is of interest. A *law of biogenesis* on the development of mammalian embryos led to the *biogenetic Law* formulated by Huxley in 1859. The development of an individual was a condensed history of the development of the race. This law is generally known as the *Theory of Biogenesis* (*q v*).

The fact that life is derived from pre-existing life is in accordance with the general recognition of *biogenesis* as established by Pasteur. It has been to scientific study chiefly bound up with cytology in the attempt to find a physical mechanism for the transmission

sion of hereditary characteristics, and with genetics (*qv*), plant and animal breeding, under controlled conditions, to supply accurate facts as to the mode of inheritance and the influence of environment. *Eugenics* may be regarded as a subdivision of heredity, devoted to the study of inheritance with special application to man and the transmission of characteristics tending to produce mental and physical perfection.

The occurrence of various forms of living organisms in particular regions of the globe is considered under *geographical distribution (qv)*. Some animals and plants are endemic to these regions, others have been introduced accidentally and intentionally, by man or other agents, and may have to undergo a process of acclimatisation (*qv*) before they become successfully adapted to their new homes. Certain animals and certain plants tend to be found associated in particular regions which may, geographically, be very small. Animal and plant communities and associations are studied separately as ecology (*qv*).

*Marine Biology* Since in the sea there are many physical and chemical conditions different from those operative on land, marine organisms frequently have particular modifications fitting them for an aquatic life. The study of marine organisms in relation to their environment is sufficiently extensive and specialised to form a separate branch of biology, and marine biology was definitely established in the early part of the 19th cent.

The effect of pressure on plants and animals is much more marked in the sea than on land. A land organism growing in a depression 300 ft below sea-level would be subjected to an additional atmospheric pressure of less than 2 oz per sq in, whereas an organism 300 ft below the surface of the sea would have to bear an additional pressure of nearly 140 lb per sq in. Some fish are enabled to swim at different levels by means of hydrostatic organs, altering their density. These organs are particularly well de-

veloped in certain fishes living in deep water, and having bladders containing air at a very high pressure, counterbalancing that of the water.

All the true marine plants are algae (*qv*). Although flowering plants are found by the sea-shore and may be partly or wholly submerged at high tide, they are rooted in the soil and studied usually as land plants found in salt marshes, swamps, and strands. The rooted algae found in shallow water are able to bend to and fro with the water currents, and thus offer little resistance to the pressure. Many algae are not fixed, and either float freely on the surface, or move just below it.

Land plants may, in consequence of overshadowing, have difficulty in obtaining adequate light. Marine plants are affected by the absorption of light by the water, and their distribution at different depths is controlled partly by this factor. The different pigments in the blue-green, green, brown, and red algae enable them to use light of different wave-lengths. Red rays can penetrate farthest into water, blue and green rays least. Consequently, the red algae are found at the greatest depths penetrated by light, the blue-green and green algae are on the surface or rooted in shallow water, and the brown algae grow mainly at an intermediate depth, although the regions of the groups overlap to some extent.

The difficulty of receiving adequate light is experienced also by the marine animals. Some of these are blind, and dependent on tactile and pressure sensations, others have luminous organs which illuminate the water. Absence of protective coloration is a marked characteristic of animals found in the unilluminated depths of the sea.

The floating mass of small plants and animals, and their eggs, found almost everywhere on the surface of the sea, is termed *plankton*, which means "wafted". Some of the organisms of the plankton have also been found below the surface, and are believed to make definite up and down movements in addition to their established superficial

wanderings Plankton is devoured by fishes sperm whales and many other animals

**Applications of Biology** The various branches of medicine receive considerable aid from biology Knowledge of morphology and particularly of human anatomy is essential to the surgeon to the dentist and to the anthropologist Biochemistry in its study of internal secretions of toxins and antitoxins and of chemotherapy (qv) has given valuable information to doctors and bacteriologists Knowledge of embryology is indispensable to obstetricians and to gynaecologists The anatomy and physiology of the nervous system must be studied by neurologists and to some extent by psychologists Marine biology is in addition closely allied in some of its aspects to hydrography and oceanography Knowledge of living organisms is essential also to the study of palaeontology

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**Biotope**, see *Mica*

**Birch** (*Betula*) woodland tree usually with silvery bark with representatives all over the world The birch is a good tree for the small garden requiring little space Besides *Betula alba* the common silver birch there are *B. pubescens*, *B. pendula* and *B. pendula* Younglings weeping birches of graceful habit *B. pubescens* the purple leaf birch *B. papyrifera* the paper birch of America *B. Delavayi* *Forrestii* a rare birch from the E Asia mountains

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**Birds**, warm blooded egg laying vertebrate animals with the fore limbs converted into wings But the essential distinctive feature of the class is the covering of feathers (qv) Birds are related to and descended from reptiles but it is only on their scaly legs and possibly the horny beak that birds have inherited the covering of their ancestors Feathers are the warmest clothing known and hence are specially beneficial to birds which are active at all seasons by keeping at a uniform level the temperature of the body which on the average is a few degrees higher than in mammals Having a four-chambered heart and a single aortic arch birds differ from reptiles and resemble mammals but the aorta on leaving the heart turns to the right and not to the left side as with mammals The lungs have little capacity for expansion but are supplemented by extension into air sacs which spread to all parts of the body even into the longer bones

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narrow, as in the swallow and peregrine falcon, which are swift fliers, and turn quickly in the air

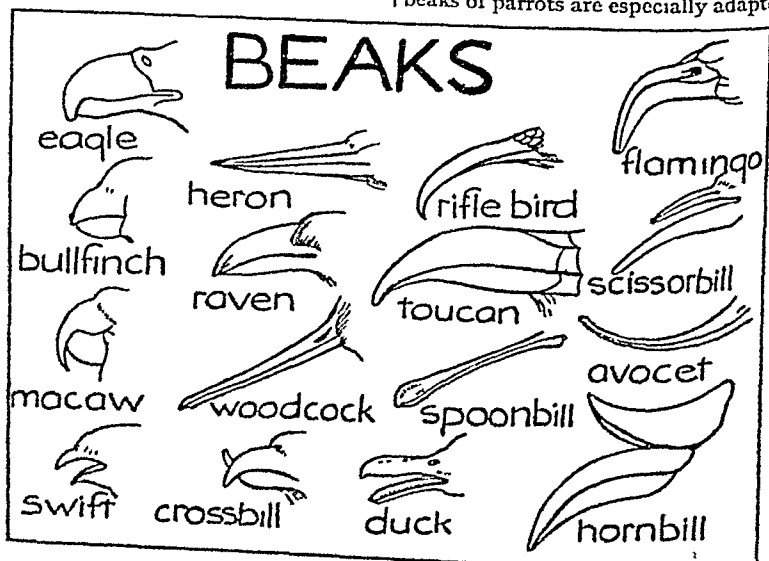
The actual speed of different birds is very difficult to determine. From observations made from aeroplanes it has been noticed that many small birds can travel at a rate of over 35 m per hour. In one instance swifts were seen to fly without apparent effort round a machine travelling at 68 m per hour.

Flight is usually achieved by flapping the wings, but when once a certain velocity has been reached, many birds glide through the air without apparent movement of the wings. Perhaps the most proficient in this respect is the long-winged albatross (*q v*), which can encircle a ship in its gliding flight.

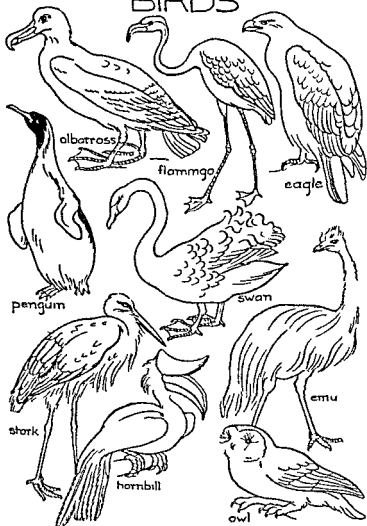
Such birds as buzzards soar by means of a spiral glide, but the soaring of the lark is effected by rapid down-strokes of the wing. Stationary or hovering flight as practised by the kestrel (*q v*) is also achieved by very rapid flapping of the wings.

Although wings and the power of flight are distinctive of most birds, the wings in some species, like the kiwi of New Zealand and the emus and cassowaries (*qq v*) of Australia and Papua, are so reduced in size as to be entirely useless for flight. They are larger in the ostrich and the rhea (*qq v*), in which they are used to give increased speed on ground. In other flightless birds, like penguins (*q v*), the wings have lost all their flight feathers, and act only as swimming paddles. They serve the same purpose in some other fish-hunting birds, as the guillemots and puffins (*qq v*), but in these they have retained their long feathers, and are used for flying as well.

The structure of the beak is adapted to the nature of the food eaten, and varies accordingly. A few instances only can be cited. In insectivorous birds, like swallows, it is usually small and soft. In seed-eaters, like finches, it is stout and conical. In birds of prey, eagles, etc., it is hooked for tearing flesh. The strong curved beaks of parrots are especially adapted



## BIRDS



for cracking hard nuts, but are also used for climbing. In some birds like herons (*q v*), the bill is long straight, and sharp, for striking prey, but its length, like that of the neck is used in conjunction with long wading legs. In the ducks, the bills are short and flattish, and provided at the sides with ridges for food-sifting. A very specialised fish-catching bill is found in the pelican (*q v*).

The legs are also adapted to the habits of the birds. Typically there are four toes, but the number is sometimes three or even two, as in the ostrich. The inner toe, when present, is set behind the rest, and in ground-living birds is small and apparently useless, but in typical perching birds, and birds of prey, like hawks, it is large and opposable to the rest for grasping. In specialised climbing birds like parrots (*q v*) and others, two of the toes are turned backwards, to give a secure clutch to a branch. In most swimming birds the toes are webbed, sometimes all four, as in the cormorant and pelican, sometimes three, as in the ducks and gulls. In typical running birds like the ostrich and allied species, and in the waders, like flamingoes and cranes (*qq v*), the legs are long. Such birds usually have long necks, and sometimes long bills, so that they may pick food off the ground. The swan (*q v*) is somewhat exceptional in having a long neck with short legs.

Of the special senses of birds, the least developed are smell and touch. In some species, like the kiwi and woodcock, which probe the ground for worms, the sense of touch is well developed at the tip of the bill, but otherwise, on account of the close covering of feathers on the body and scales on the legs, there are no special tactile areas on the skin. There is little evidence that birds either find food or ascertain its qualities or are warned of danger by the sense of smell. Their hearing, on the other hand, is tolerably keen, but not nearly so keen as that of most mammals, and no bird

has a tubular external ear or pinna for the collection of sound waves. The sense of sight, however, in most cases is probably superior in its range of vision to that of any other animal. As evidence of this may be cited the rapid assembly of vultures to devour a carcass, when not a single specimen is visible to the human eye.

Some birds sing or utter vocal sounds throughout the year, but this habit usually reaches its highest form of expression, particularly by the cock birds, before and during the pairing season. These vocal efforts are a phase of the courtship of birds. Another phase equally well known is called the display, when the cock bird exhibits his bright colours or gorgeous plumes to the hen. This is practised by pheasants, birds of Paradise (*qq v*), and many others. During the display, the cocks often assume the most fantastic attitudes, well illustrated by the great bustard (*q v*), and the ostrich. Other birds perform strange flights in the air or behave in an apparently ridiculous manner, bowing and bobbing up and down before the hen. Both sexes sometimes execute the same antics, and sometimes it is the hen that assumes the activities of courtship.

As a rule eggs are laid in nests varying from the simplest to the most complex. Some birds, like the guillemot and nightjar (*qq v*), make no nest. Others are content with a shallow pit in the soil. Usually nests made in trees or bushes are the most elaborate, but the wood-pigeon's nest is a simple platform of twigs in a high tree.

But whatever material be used, a simple nest is typically shaped like a saucer or shallow bowl to keep the eggs from falling out and in a close cluster for incubation.

A modification of this kind of nest is the domed nest of the wren (*q v*) with an entrance left at one spot for the entry of the parent. The materials used for nest-building are usually pliable substances, like grass, moss, lichen, twigs, seaweed, etc., the nest being lined in some cases with hair or

down but sometimes soft mud which subsequently hardens is employed at least as the foundation more rarely as the lining and each species normally has a characteristic nest which can be easily recognised.

The nesting site is equally varied the bird's power of flight giving it infinite choice. In most cases the site is characteristic of the species but some birds like herons will nest in any suitable spot.

Of the eggs little need be said here. After reaching full size they are at first soft and white but during the passage down the oviduct the calcareous shell is deposited and the colours are laid on by a secretion from pigment cells. In some species especially ground nesters the colours of the eggs harmonise with the surroundings but this does not apply to eggs laid in concealed nests. The number of eggs laid in a clutch varies from 1 in the kiwi or 2 in the pigeons to something like a dozen in some of the pheasant species the fertility as in other animals being as a rule a measure of the mortality of the individuals of the species. The incubation of the eggs and care of the young sometimes fall on the hen alone sometimes they are shared by both parents whereas in a few cases the tinamous for example the cock bird takes the sole responsibility.

When ready to hatch the young bird breaks the shell by means of an egg tooth on its beak.

The newly hatched nestlings vary considerably in development. Usually they are clothed with down but some are naked others thickly covered. Apart from the instinct to take food from the parents they may be helpless and blind or they may be hatched with the eyes open and capable under the parents' care of picking up food for themselves. Amongst the nestlings helpless at hatching are kingfishers and woodpeckers which nest in holes and young naked perching birds such as herons and cormorants

in which a thick down appears soon after hatching and hawks pigeons petrels and others in which the downy covering is complete from the start.

To the second group comprising the more primitive birds belong the ducks fowls ostriches and others which are mostly ground nesters. But there are many stages between the two categories.

One of the most interesting phenomena connected with birds is the migratory habit particularly prevalent in species which breed in countries with marked seasonal differences of temperature. The question of migration is intricate and not yet fully understood. A comparatively simple case is supplied by swallows and swifts which like bats feed on insects caught on the wing. These insects disappear with the onset of cold weather. Bats avert starvation by hibernating but swallows and swifts unable to hibernate are compelled to go to warmer climes where the insects they want are to be found. It is not clear why swallows sometimes travel all the way from Europe to S. Africa as has been proved by ringed birds. In the latter case food seems to be undoubtedly the determining factor in migration but in explanation of their making the return journey instead of staying in a district where food is always plentiful it can only be supposed that they are moved by the homing instinct.

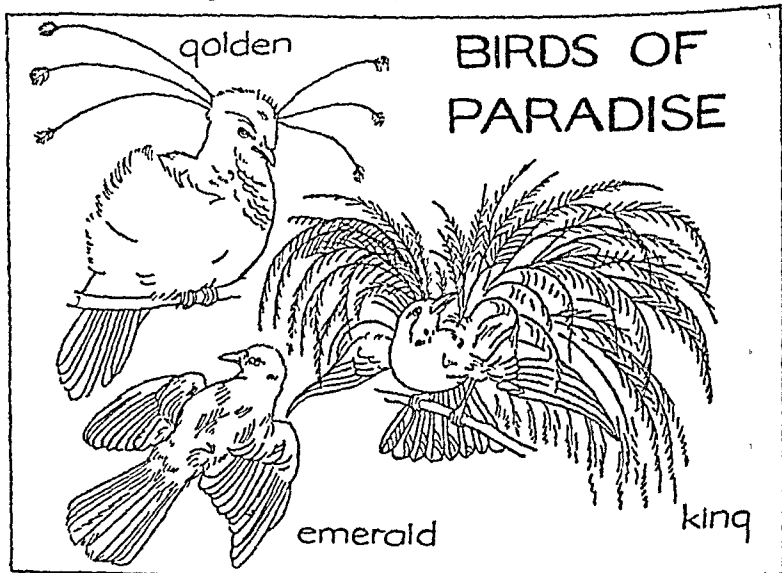
A simpler case of migration probably also attributable to feeding is the descent of grouse in winter from high moorlands to the valleys. Yet another instance on a comparatively small scale is illustrated by the gulls which frequent the Thames and London parks in the winter and retire coastward in search of their marshland nesting sites in the spring. Here the migration is a question of breeding not of feeding.

It was once thought that cold was the primary cause of migration. It is however only an indirect cause. Birds as a class on account of their feathery covering are on the whole

little susceptible to cold. It is noticeable, for instance, that birds like tits, robins, and starlings are undisturbed by the winter, and stay in England during that season, because they are able to feed themselves.

It is customary to classify migratory birds into summer visitors, like swallows, cuckoos, wheatears, wry-necks, etc., which come from the S to breed, winter visitors, like the redwing and some ducks and geese, which have

As a whole the class is remarkably homogeneous, the extreme forms hardly differing more from one another than the representatives of a single order of mammalia such as the marsupials (*q.v.*). Birds, nevertheless, have been divided into a vast number of orders, families, and other groups, primarily based upon obscure differences in the skull, and ornithologists are not in complete agreement about the correct classification.



bred farther N and come to us to winter, and passage migrants, which may alight and stay for a short time in Great Britain on their way to more southerly or northerly lands.

It must be remembered that in carrying out their migratory movements birds appear to be solely driven by instinct. The instinct is dormant during certain seasons of the year, but from recent experiments it seems probable that the instinct is stimulated by internal secretions of the nature of endocrines (*q.v.*)

**Birds, Cage, see AVICULTURE**  
**Bird Sanctuaries, see NATURE RESERVES.**

**Birds of Paradise**, a family of birds akin to the crows, found in the Papuan Islands. They take their name from the luxuriance and beauty of the plumage of the cock birds.

**Birdwood, Sir Wm. Riddell, Bart.** (b 1865), field-marshal, entered the Army from Sandhurst in 1883. In the S. African War he was present at the battles of Colenso and Spion Kop and the relief of Ladysmith. In the

World War he won great fame and the affection of his troops in the Gallipoli campaign where he commanded the Australian and New Zealand Army Corps (the Anzacs) and later on the W. front where he led them in the autumn offensive of 1918. In 1920 he was given the command of the Army of N India. In 1925 he became a field marshal and Commander in Chief in India. In 1931 he was appointed Master of Peterhouse Cambridge.

**Biretta**, a square cap worn by priests in the Roman Church and in the Anglo-Catholic section of the Church of England. Its colour is black for priests, purple for bishops, red for cardinals and white for the Pope.

**Birkbeck, George (1776-1841)** physician and philanthropist whose interest in working-class education in Glasgow led him to found with Lord Brougham, Jeremy Bentham and Cobbett the London Mechanics Institute (1833). Later this name was changed to Birkbeck College and it became a part of London University.

**Birkenhead**, port and industrial and export centre of Cheshire at the mouth of the Mersey connected by a ferry and tunnels with Liverpool. There are miles of docks, quays and harbour works. Shipbuilding is an important industry and there are great flour mills, breweries and iron foundries. A small village at the beginning of the 19th cent. it had in 1931 a pop. of 147,946.

**Birkenhead, Fredk. Edwin Smith, 1st Earl of (1872-1930)** son of Fredk. Smith, barrister (d. 1887). As an undergraduate of Wadham College Oxford he distinguished himself becoming President of the Union. He was called to the bar at Gray's Inn in 1899 and established a practice in Liverpool where he became very well known as F. E. He came to London in 1902.

In 1906 he became a Conservative Member of Parliament. His maiden speech an attack on Free Trade and his **Lords** the Commons gave him a

reputation for contentious oratory. A Privy Councillor in 1911 his strong opposition to Irish Home Rule brought him notoriety. Under Asquith's coalition of 1915 Birkenhead was recalled from a post in France and appointed Solicitor-General and later Attorney General. Under Lloyd George he was raised to the peerage and appointed Lord Chancellor in 1919 in which position his eloquence was heard at its best. In the Baldwin Ministry of 1924 Birkenhead was Secretary for India but his division of his time between his ministerial duties and journalism caused some criticism. He resigned in 1928 to take up directorships in several large business concerns.

As counsel and Lord Chancellor he was pre-eminent. His judgments in *Beard's case* dealing with drunkenness as an excuse for crime in the Rhondda Peerage case laying down that peeresses in their own right cannot sit in the House of Lords in the case of *Bourne v. Keane* dealing with the validity of trusts for the saying of Masses for the repose of the souls of the dead are all important contributions to English law while the Law of Property Act 1922 which he sponsored in Parliament has revolutionised the English law of real property (qv).

**Birkin, Sir Henry Ralph Stanley Bart (1896-1933)** English racing motorist. He began racing in 1927 won the 6-hour race at Brooklands in 1928 and the Le Mans 4-hour race in 1929 and 1931. He died of blood poisoning from a burn received while competing for the Grand Prix de Tripoli in May 1933.

**Birmingham** (1) Second largest city of England near the N.W. border of Warwickshire with extensions into Worcestershire and Staffordshire. With other towns of the Black Country including Coventry, Walsall and Dudley it forms part of the great metal manufacturing area of the Midlands. Birmingham's leading industry is the manufacture of brass goods but of nearly equal importance are iron

and steel manufactures, engineering, chemicals, motor-cars, pins, nails, tools, etc

Owing to its rapid rise in the late 18th and 19th cents, Birmingham is not regularly laid out, but there are many noteworthy buildings. The University and such schools as the Edward VI Grammar School (dating from the 16th cent) are well-known buildings.

Birmingham is well provided with parks and open spaces, and the city prides itself on possessing a particularly efficient local government.

Among famous names associated with Birmingham are those of Joseph Chamberlain, who was Mayor 1874-1876, James Watt, and John Bright.

The history of the city goes back to Saxon times, it is mentioned in the Domesday Book, and was acquired by the Bermingham family after the Conquest. It later passed to the Duke of Northumberland, who held it until his attainder. It sided with Parliament in the Civil War, and was embroiled in the Chartist riots. It became a city near the end of the 19th cent. Pop (1931) 1,002,413.

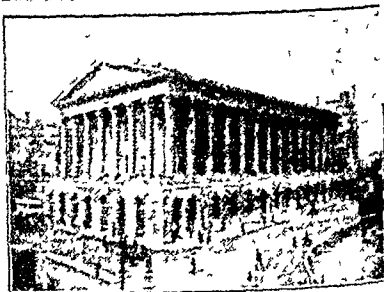
(2) One of the most important industrial towns in the S of the U.S.A., situated in Alabama, a few m. E. of the Tombigbee R., the heart of a rich mineral area producing iron, coal, limestone, and graphite, and an important chemical, engineering, and electricity centre. In addition to its



Birmingham University, East Entrance

manufactures, it is a large market for cotton and the other agricultural

products of the South. Pop (1931) 260,000



Birmingham City Hall

Birrell, Augustine (b 1850), essayist and politician, Professor of Law in London University (1896-9), best known, as M.P., for his witty oratory, known as "birrelling". He was Liberal Minister of Education (1906-7), and Chief Secretary for Ireland (1907-10). He retired in 1918. His essays are of wide scope and delightful style, they include *Obiter Dicta* (1884, 1887, 1924), *Men, Women, and Books* (1894), and *Res Judicatae* (1892).

Birth, see REPRODUCTIVE SYSTEM

Births (in law) Births must be registered with the local registrar of births, marriages, and deaths, within 6 weeks of the event. The obligation rests on the parents, or on any person who has charge of the child; in the case of an illegitimate child the mother must perform the registration, and the father's name can only appear with his own consent and that of the mother. In many districts written notification must also be given within 36 hours to the local medical officer of health, the penalty for default being 20s. Any person who conceals, or attempts to conceal, the birth of a child by any secret disposition of its body, whether it died before, after, or at the time of the birth, is guilty of a misdemeanour punishable by 2 years' imprisonment with hard labour.

Biscay, see VIZCAYA

Biscay, Bay of, an Eastern portion of the Atlantic, bounded N. by the

French department of Manche E. by the E. coast of France and S. by the N. coast of Spain. The Loire and Garonne are the two principal rivers flowing into it. Its exposed position has made it notorious for storms.

**Biscuits** The word comes from the French and means twice baked. Biscuits take a large part in modern diet as they are cheap to buy and if stored in air tight tins keep indefinitely. Various types of manufactured biscuits are available ranging from sweet rich biscuits made of butter, eggs and milk to plain biscuits of flour and water. A modern development in keeping with the rising interest in diet for slimming and general health is the production of thin hard biscuits consisting of whole meal flour and usually a proportion of fat.

**Bishop** ecclesiastical dignitary of the Christian Church. He has spiritual charge over an area called his diocese. A bishop is held to be endowed with divine authority from St. Peter through the Apostolic Succession (q.v.) to ordain priests and deacons and other orders. He also administers the rite of Confirmation, consecrates churches and altars and exercises disciplinary rule over the clergy. Church of England bishops are chosen by the Crown. Roman Catholic bishops are appointed by the Pope usually in agreement with the State authorities.

**Bishop Sir Henry (186-1835)** English musical composer wrote *Home Sweet Home* besides some 80 operas, light operas and ballets. Conducted at Covent Garden and at the London Philharmonic concerts. Of his many works only a few of his songs have survived.

**Bishop's Stortford**, railway junction and market town of E. Herts. on the R. Stort some 30 m. N.E. of London. Brewing and malting are the chief industries. There is a Perpendicular church, an Elizabethan grammar school, Bishop's Stortford College, a public school founded (1868) for nonconformists and a training college for women.

teachers. Cecil Rhodes was born here in 1853. Pop. (1931) 9,000.

**Bishops Trial of the Seven (1688)** see DECLARATION OF INDULGENCE

**Biskra**, an inland town of Algeria and the principal settlement of a Saharan oasis watered by the intermittent Wad Biskra. It is the S. terminus of the Algerian rail system and a favourite winter resort. Large quantities of fruit, especially dates, are grown in the vicinity. The town is a military post and was the scene of severe fighting in the native rebellions of 1849 and 1871. Pop. c. 25,000.

**Bisley** small Surrey town a few m. from Woking famed for the rifle shooting competitions held here on the ranges of the National Rifle Association. See SHOOTING.

**Bismarck** American town capital of N. Dakota. It lies in a great farming region and deals largely in agricultural produce, importing manufactured goods for the whole region. Of interest is the log house taken from the late President Roosevelt's ranch which is situated in the grounds of the capitol. Bismarck is an important railway centre and airport. Pop. (1930) 11,000.

**Bismarck, Otto Eduard Leopold von, Prince (1815-1898)** German statesman through whose activities the unity of Germany under Prussian domination was born. From the University of Göttingen he entered the diplomatic service but it was not until 1847 when he married Johanna von Puttkamer that he gave any sign of his future greatness. In that year he was a deputy member of the first Prussian Parliament and spoke sternly against the revolutionary state of mind that was in evidence all over Europe at that time. He was always a Conservative of the strictest kind and adhered closely to the doctrine of the divine right of kings and the scarcely less divine rights of the aristocracy. His "Olmütz Speech" of 1850 advised caution and the strong consolidation of Prussia before any attack on Austria was to be made. In



representative for Prussia at the Diet of Frankfurt, and such he remained for 7 years. During this time he realised that a war, not an alliance, with Austria was the only way to bring about a union of the German States under the leadership of Prussia. From his ambassadorship at St Petersburg (1858-62) and in Paris, he was recalled to Prussia, where he was made Minister-President (1862), a difficult position in view of the quarrel between King William I and his Parliament.

His qualities of determination and resource, and his great love of Prussia, whose fortunes he sought to advance at any price, now became apparent. In 1863 he kept Prussia out



Prince von Bismarck

of the counsels of the Frankfurt meeting of German princes. In 1864 the Schleswig-Holstein question came to a head. Prussia, with Austria as an ally, declared war on Denmark, defeated her, and annexed the two duchies. In 1866 occurred the Seven Weeks' War (*qv*) with Austria, in which Prussia was uniformly successful. In view, however, of the attitude of France, Bismarck made very moderate terms with Austria. Friction between France and Prussia grew over French schemes to annex Luxemburg and Belgium, and by 1870 war was inevitable.

Bismarck threw down the gauntlet by his publication of the "Ems Telegram." In this, King William refused Napoleon's request to restrain Prince Leopold von Hohenzollern-Sigmaringen from accepting the throne of Spain. The Franco-Prussian War, ending with the defeat of France in 1871, completed the dominance of

Prussia over the rest of Germany, which it has ever since retained, and afforded the opportunity for the federation of the German States outside Austria in a union under Prussian leadership. In 1871 the new German Empire was founded and Bismarck was made a prince and appointed imperial chancellor.

Bismarck's autocratic methods annoyed Emperor William II (who succeeded William I in 1888), and he resigned in 1890. He remained, however, a national hero. Bismarck was undoubtedly the greatest modern German statesman and one of the most successful advocates of the "blood and iron" policy.

**Bismuth.** For the characteristics of bismuth see article **ELEMENTS**. Bismuth is a metallic element frequently found in the native state. It is purified by melting and by running off the pure metal from the contaminating substances. The oxide and the somewhat rare sulphide also occur and the metal is recovered from these by reduction with charcoal.

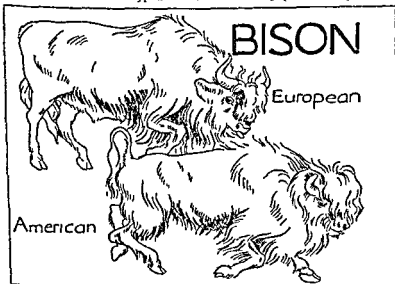
The metal is used to a considerable extent as a constituent of alloys, since it has the important property of expanding on cooling. Bismuth is a constituent of a large number of low melting alloys such as *Wood's metal* (melting-point  $71^{\circ}\text{C}$ ), *Rose's metal* (melting-point  $93.8^{\circ}\text{C}$ ), and *Lipowitz' alloy* (melting-point  $60^{\circ}$ ). These alloys all contain 50 per cent. of bismuth alloyed with various proportions of lead, tin, and cadmium. They find numerous important applications in the manufacture of fuse-wires, boiler safety-plugs, and plugs for automatic sprinklers; these latter melt on a rise in temperature, and release the water.

The compounds of bismuth find application almost exclusively in medicine, although some small quantities of bismuth trioxide are used as a pottery glaze, and of the chromate as a pigment. The function that bismuth salts fulfil in pharmacology is mainly that of a safe and non-irritant antiseptic and soothing agent for the

digestive canal. For this purpose they have been used for several centuries as well as for the improvement of the complexion. One of the salts used for these purposes is *bismuth subnitrate*  $\text{BiONO}_3 \cdot \text{H}_2\text{O}$  also known as Spanish white. When mixed with iodoform and wax this salt is also used as an antiseptic ointment under the designation BIP. The injection of colloidal metallic bismuth suspended in oil for the treatment of syphilis has

bismuth sulphate the subcarbonate is used also.

Bison are wild cattle represented by two living species one found in Europe the other in N America. The horns and tail are comparatively short and the thick woolly coat is especially long on the neck and throat where it forms a kind of mane. The European species is now nearly extinct the few specimens that still survive being protected by the in



gained considerable vogue of late. A very important use of bismuth in medicine is as an indicator in X ray photographs. Bismuth is an element of considerable density and as such is opaque to X rays. It is thus introduced into the alimentary canal mixed with gruel on taking X ray photographs at definite intervals the progress of the meal through the system can be watched and any abnormalities in the configuration of the digestive tract will be clearly shown. The salt usually employed for this purpose is

fluence of the Bison Society. The American species generally known as buffalo in that country formerly inhabited the prairies of the United States in countless thousands but was almost exterminated by the Indians and early European settlers. It is now strictly preserved.

Bissextile is a term applied to leap year. Literally it means twice six and originates from the practice in the Roman calendar of reckoning the 6th day before the kalends of March twice in every leap year. See also CALENDAR.

**Bissing, Moritz Ferdinand von** (1844-1917), German Governor-General of Belgium during the German occupation (1915-17). He signed the warrant for the execution of Nurse Edith Cavell (qv).

**Bithynia**, ancient district in the NW of modern Asiatic Turkey, with large forests, and fertile fruit-producing valleys. The silkworm is cultivated, and the silk from the Brusa district is famous. Lack of transport prevents the timber and coal that are known to exist from being fully exploited. The only towns of modern importance are Scutari and Brusa. Bithynia was held by the Persians in the 6th cent. B.C., became independent, and later fell to the Romans.

**Bittern**, a bird akin to the heron. It lives in marshes, and is remarkable for its protective resemblance to the reeds, and for its "booming" nocturnal cry. It was formerly not uncommon in the fen country and similar sites in England, but is now rare in this country.

**Bitters**, infusions of bitter vegetable substances, are used in medicine as tonics, and in cocktails as appetisers. Rectified spirit is added to the infusions to prevent them from putrefying. Angostura, quassia, gentian, and orange are amongst the best known.

**Bittersweet** (*Solanum dulcamara*), the climbing nightshade of the hedgerow.

**Bitumen**, an impure mixture of hydrocarbons, including in the wide sense such substances as asphalt, natural gas, petroleum (qv), and other related deposits. The gaseous and liquid forms are probably contemporaneous with the strata in which they are found, but it has been claimed that the more solid kinds have arisen by the alteration of liquid petroleum. More strictly, the term is applied to a form of pitch resembling asphalt, but purer, softer, and more difficult to work. In ancient times bitumen was used as a kind of mortar, and is alleged to have been employed in the building of Babylon. It was used by the

Egyptians in their processes of embalming.

**Bivalves**, animals provided with a shell composed of two valves hinged together, e.g. the oyster and the mussel. They are members of either the phylum *Mollusca* or *Brachiopoda*.

**Bivouac**, an impromptu open-air camp, without tents, the soldiers remaining dressed and alert for speedy action. The word is said to have been introduced during the Thirty Years War.

**Bizerta**, [BE'ZART'A], French port and naval station in Tunisia. It is more important strategically than commercially, and the port is, after Toulon, the French Navy's most important base in the Mediterranean. Pop. (1931) 23,200.

**Bizet** [pron BE'-zā], Georges (1838-1875), French musician and composer of one of the finest and most popular of the operas—*Carmen*—was born in Paris and became a student at the conservatoire there. He was awarded the Prix de Rome in 1857. He composed *Vasco da Gama* in 1863 and *The Pearl Fishers* in the same year, his *John Fille de Perth* was produced in 1867. *Carmen* was not given to the world till 1875, 3 months before the composer's death. It is a work of great variety and originality, showing a fine sense of musical characterisation, and is cleverly orchestrated. Bizet wrote also over 100 songs and instrumental pieces.

**Björnson, Björnsterne** (1832-1910), Norwegian dramatist, poet, and novelist, first became famous for a great dramatic trilogy, *Sigurd the Bastard* (1862), and similar dramas, in which he depicted the peasantry of his country in an heroically historical light. As manager of the Oslo Theatre he produced *The Newly Married*, a comedy, and *Mary Stuart in Scotland*, a tragedy. About 1870 he became associated with radical tendencies in politics, and embodied his social views in such dramas as *A Bankruptcy* (1874) and *A Gauntlet* (1883). As a poet he is known for *Arnljot Gelline*, an epic cycle which includes some fine lyrics.

The most notable of his novels is *In God's Way* (1883). His political views involved him in a charge of high treason and for some years he lived in retirement in Germany. He was awarded the Nobel prize for literature in 1903.

**Black, William** (1841-1898) Scottish journalist and novelist was a war correspondent in 1866 during the war between Austria and Prussia. Of his novels some of the best remembered are *The Strange Adventures of a Phaeton* (1877) *Madcap Violet* (1876) *White*

*Heather* (1885) and *Wild Eelin* (1898).

**Black Ash**, see ALKALI INDUSTRY.

**Black Assize** a plague which broke out at Oxford in 1577 after the assizes sparing women and children but striking down among the others the sheriff as well as many jurors and court officials. It was regarded as divine retribution on

leaves are large and five-lobed or cut into leaflets covered with tiny prickles. The flowers are white or pink with delicate petals which soon fall. The fruit ripens in Sept. and consists of a large number of drupes borne on an upright receptacular structure.

**Blackbird**, a common British song bird related to the thrush but with the sexes unlike the adult hen being brown and the adult cock black with a yellow bill. It is also found in Europe, N. Africa and Asia.

**Blackbuck**, an Indian antelope (q.v.) akin to the gazelles but with spiral horns. It takes its name from the male turning from fawn to black on the upper side on reaching maturity, this change being sometimes transient and occurring only in the breeding season.

**Blackburn** (*Colin Blackburn*) Baron (1813-1896) British judge born in Selkirk, Scotland. Appointed a judge in 1859 at a time when he was completely unknown outside the legal profession. When in 1866 he became a member of the Court of Appeal and in the same year was made a Lord of Appeal he was generally recognised as one of the greatest authorities on the common law in English history. Editor of *Littis* and *Blackburn's Law Reports* and author of *The Law of Sales*.

**Blackburn** Lancs. town c. 10 m. E. of Preston. The main industry is cotton weaving which employs a large proportion of the working population. Coal mining, ironworks and engineering are also of importance. Blackburn was a woollen centre in earlier centuries and later turned to the making of linen and cotton fabrics. The development of coal and iron and the spinning jenny introduced by Hargreaves assured the rapid growth of the town in the last century. Pop. (1931) 122,695.

**Blackcap** see WARBLER.

**Blackcock** the male of a species of grouse (q.v.) of which the female is called the Greyhen. The two names alluding to the marked difference in colour between the sexes although the hen is brown rather than



Blackberry

injustice

**Blackband Ironstone**, see IRON AND STEEL.

**Black beetle** see COCKCHAPEL.

**Blackberry** a common fruit of the hedgerows also often cultivated. The plant belongs to the family Rosaceae. It is a trailing plant, producing long stems from the roots which scramble over any convenient support. The

grey The species also differs from the Red Grouse in having the toes unfeathered and, in the cock-bird, by the lengthening and outward curvature of the outer feathers of the tail It is found in heath country in England, Wales, and Scotland, but feeds largely on berries and corn

**Black Country**, a designation of the industrial districts of the English Midlands between Birmingham and the Potteries The name arises from the number of coal-mines and factories, and the smoke-grimed appearance of many of the towns There are a number of canals in the district

**Black Currant**, *see* CURRANT

**Black Currant Mite** is a very serious problem to growers of black currants, it also attacks red and white currants, and gooseberries The mite is less than  $\frac{1}{16}$  in length, and appears only as a tiny white speck Badly infected bushes should be burnt and the remainder sprayed in early spring with a strong solution of lime sulphur (1 part of concentrated lime sulphur to 11 parts of water)

**Black Damp**, *see* COAL-MINING

**Black Death**, a plague which ravaged Europe in 1348-51, reaching England in 1349, carrying off about a third of the entire population

The consequent depopulation resulted in a shortage of labour Although modern scholars are inclined to minimise the economic effects of this plague, it must have hastened the process of commutation of labour services into money rents, by strengthening the position of the villeins

**Black Earth Area**, administrative district of the USSR extending roughly from the NW of the Don Cossack Territory to the SE of the Tula province, created in 1928 Most of the area consists of large and fairly fertile plains of the peculiar soil which gives the district its name Crops include cereals, fruit, potatoes, sugar-beet and hemp Sheep, pigs and cattle are raised About nine-tenths of the people are engaged in agriculture Industries include flour-milling, sugar-

beet manufacture, and oil-pressing from seeds Saw-milling is important, as timber is a staple natural product Coal has been found, but is not yet much worked, and iron and gypsum are known to exist Transport and electrical power are receiving attention, with a view to the exploitation of the minerals

The climate is extremely cold, and the conditions of life are on the whole rather poor. The chief towns are Voronezh, the administrative capital, Orel, Kursk, and Lipetsk, which has famous mineral springs Area, 77,000 sq m. pop (1927) 11,600,000.

**Blackfeet**, *see* R&D INDIANS

**Blackfly**, *see* APHIS

**Black Forest**, (Ger., *Schwarzwald*), a beautifully timbered tourist-resort in Württemberg, 1840 sq m The chief industries of the district are timber and toys. Pop (1925) 583,524

**Black Friars**, popular name for the Dominican order of Friars, from the black mantle worn by them (*see* DOMINICANS), the name was given to the district of London in which the pre-Reformation Dominican convent stood

**Black Friday**, in the British Labour movement, April 15, 1921, when the Triple Alliance of the Miners, Railway men, and Transport workers, which had declared a strike in all sections in support of the miners, decided to call it off, thus leaving the miners to fight alone

**Blackheath**, suburb of S E London, part of Greenwich borough On this heath Wat Tyler and his men assembled, the citizens of London welcomed Henry V after Agincourt, and Jack Cade encamped in 1450 at the Restoration, 1660, Charles II was met here by the army and triumphantly entered London During the 18th cent the heath became a favourite haunt of highwaymen, it is now a pleasant playground

**Black Hole of Calcutta**, the name which perpetuates the memory of Suraj-ud-Dowlah's inhuman confinement (1756) of 146 English prisoners

in so small a room that only 23 of them survived one stifling night of such treatment *See also* CLIVE ROBERT

**Blackie John Stuart** (1809-1893) was a Scottish scholar whose most important work was a translation of *Æschylus* (1850). He was Professor of Greek at Edinburgh University from 1852 to 1882.

**Blacking and Leather Polish** Formerly boot blacking consisted chiefly of sugar and oil and produced only a poor polish. Modern blacking and shoe polishes are all compositions of beeswax and other waxes with turpentine or substitutes coloured with ivory black and other pigments. Soap is also sometimes added. *Dubbin* is a mixture of tallow and beeswax or other wax oil (neat's foot) and linseed oil.

**Blacklead** popular name for naturally-occurring graphite which is used for the manufacture of pencils also

known as *plumbago* *See also* CARBON

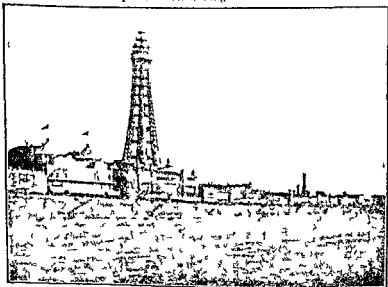
**Blackleg** a worker who refuses to join others in striking or in joining a trade union also one who takes the place of or returns to work before others engaged in a strike. Although peaceful picketing and persuasion is allowed on the part of the strikers the right and safety of the blacklegs are protected by law *See also* TRADES UNIONS

**Black Letter** the name given to Gothic or Old English type based on the handwriting in vogue when printing was invented and used in the earliest printed books. All Caxton's

*Example* **Manners Maketh Man.**

books are printed in black letter type. In a modified form it is still used in Germany though now to a large extent supplanted by Roman type.

**Black List** a list of people or things recorded as undesirable as for



Blackpool.

example, the black list of neutral traders who continued to supply Germany during the World War, drawn up by the British Government while endeavouring to carry out a blockade. Black lists of those known to be contractors of bad debts are often drawn up by business houses and trade protection associations. The Roman Catholic *Index librorum prohibitorum* may be regarded as a literary black list.

**Blackmail**, in law, the extortion of, or attempt to extort, money or property by threats of exposure or prosecution, without reasonable or probable cause for demanding the money. It is a crime subject to severe punishment. In order to encourage prosecutions, the practice is now recognised of protecting victims by the suppression of their names if desired.

**Black Mass**, a term applied to a requiem mass for the dead, also to an obscene travesty of the mass performed in connection with the cult of witchcraft.

**Blackmore, Richard Doddridge** (1825-1900), novelist, began his writings with *Clara Vaughan* (1864). His most famous work is *Lorna Doone* (1869), which in both style and subject has remained exceedingly popular and attracted a host of imitators. His magnificent descriptions of Devon scenery are classic.

**Black Nile**, see **ATBARA**.

**Blackpool**, famous Lancashire seaside resort, c. 50 m N of Liverpool. It is the main holiday resort from the great N industrial centres, and possesses the most modern attractions of every kind. Blackpool is well planned, being of quite recent growth, and has a magnificent promenade and a well-known orchestra. Pop (1931) 101,543.

**Black Powder**, see **EXPLOSIVES**.

**Black Prince**, The (Edward, Prince of Wales, son of Edward III) (1330-1376), known by that name because of the black suit of armour which he wore. Created Prince of Wales in 1343, Edward accompanied his father in France in 1346, fighting at Crécy

and Calais, led a Spanish expedition 1355, and won the Battle of Poitiers (1356), taking King John of France prisoner. He was given the Dukedom of Aquitaine in 1362, helped Pedro the Cruel to regain the crown of Castile (1367), and returned to England, resigning his Duchy of Aquitaine in 1372.



The Black Prince

**Black Rod**, Gentleman Usher of the, a chief officer of the House of Lords, a member of the Royal Household, and an officer of the Order of the Garter, who executes warrants of commitment, and has in his custody all persons detained for trial by the Lords. He assists at the introduction of new peers and "desires" the attendance of the Commons when necessary, e.g. to hear the Royal Assent to a Bill of Parliament. He is assisted by the Yeoman Usher of the Black Rod. The name is derived from the black wand, surmounted by a golden lion, which is his badge of office.

**Black Sea**, tideless inland sea in E of Europe, watering the shores of the U.S.S.R., Turkey, Bulgaria, and Rumania. The coast is low and marshy on the N, developing a barrier and rocky face S. It is 720 m from

E. to W. and c 350 from N. to S. Chief ports are to the W. Until 174 the Turks excluded all foreign vessels from the Black Sea. By a treaty of 1779 Russia gained admission followed by Britain and France in 1802. Since the conclusion of the World War the Sea has been open to the trading vessels of all nations.

**Blackstone** Sir Wm. (1731-1804) Judge of the King's Bench and Common Pleas famed mainly because of his book *Commentaries on the Laws of England*.

**Blackthorn** (*Prunus spinosa*) the sloe bush of the hedgerow the wood of which is used for walking-sticks.

**Black Watch** Formed in 1729 of various independent Highland Companies the Black Watch became a regiment in 1739. It fought in various Flanders and Irish campaigns in the 18th cent. took part in the American War (1776-) and served at Waterloo (1815) the siege of Lucknow, Egypt (1882-5) and S. Africa (1899-1902). Twenty-five battalions served in the World War.

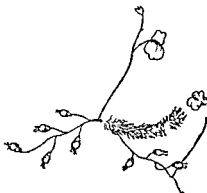
**Blackwater** name of several streams in the British Isles. The two most important are the Essex Blackwater which rises near Shenfield and flows E. to the North Sea at Maldon and the Irish Blackwater which rises on the borders of Cork and Kerry and flows into Youghal Bay.

**Blackwater Fever** a disease occurring chiefly in tropical countries and in some way associated with malaria (*qv*) though its origin is at present unknown. It is prevalent in tropical Africa and also occurs in Asia, the W. Indies, the warmer parts of the United States and even in Sardinia, Sicily and Greece. The symptoms are irregular paroxysms vomiting jaundice and a characteristic black colour in the urine due to the presence of blood. The theory that blackwater fever is due to excessive doses of quinine is now discredited and the tendency is to regard it as brought about by a parasitic protozoon. See also PROTOZOA.

**Blackwood** William (1776-1834) founded the publishing firm of William Blackwood & Sons about 1804 and in 1817 started to edit *Blackwood's Magazine* to which most of the ablest Tory Scottish writers contributed. He was succeeded in the business by his sons, the most memorable of whom was John (1818-1879).

**Bladder Worm** the sexless stage in the life history of the tape-worm (*qv*). One species infects the brain of sheep causing the disease known as staggers.

**Bladderwort**, a submersed insectivorous plant with finely divided



Bladderwort.

leaves bearing minute bladders and yellow flowers which rise above the water to open. Water insects enter the bladders by trap-doors and are digested. Before flowering the bladders are filled with air and the plant floats, but afterwards the bladders become filled with water and the plant sinks to the bottom.

**Bladensburg Battle of** (and American War) (Aug. 24, 1814) the British under General Ross defeated the Americans under General Winder who commanded the only bridge over the Potomac. The British entered Washington on the evening of the same day.

**Blaine, James Gillespie** (1830-1893) American politician who in 1884



contested the presidency against Garfield as a Republican, and was defeated after a bitter campaign, in which the slogan, "Rum, Romanism, and Rebellion" directed against his rival, proved his own undoing. Blair was an advocate of currency reform, protection and the establishment of reciprocity treaties with other countries.

**Blair, Robert** (1593-1666), Scottish Nonconformist divine, became Bishop of Down in 1623, was excommunicated in 1631, but in 1646 became moderator of the General Assembly.

**Blair, Robert** (1690-1746), Scottish poet, was the author of a blank verse poem, *The Grave*, chiefly known through the engravings made for it by William Blake (q.v.).

**Blake, Robert** (1599-1657), Admiral of the British Fleet, Parliamentarian in the Civil War, M.P. for Taunton. Blake defeated Prince Rupert near Cartagena (1650), took the Scilly Islands, distinguished himself in the Dutch War (1652), and defeated the Spaniards at Santa Cruz. He died at sea, near Plymouth.

**Blake, Wm** (1757-1827), poet and engraver, is best known for his *Songs of Innocence* (1789), which was the first of the books that he wrote, printed, and illustrated himself. Of a similar type is *Songs of Experience* (1794).



Wm. Blake

He also wrote a series of prophetic books, which, according to his claim, were dictated to him by angels; these include *The Books of Thel*, *Urizen* and *Ahaniah*, which display a complicated mythology of his own fertile invention, and are in parts almost unintelligible. A third division of

his works includes collections of witty and scurrilous epigrams—of such is *The Marriage of Heaven and Hell* (1790). His engravings are of the same nature as his poems. Grandeur of conception is allied with lack of form; he saw with the eye of a mystic. He will always be remembered as the author of such supreme lyrics as *The Tiger*, *The Little Child Lost*, and *Jerusalem*.

**Blanc, Mont**, the highest Alpine peak, situated in department Haute Savoie, France, near both the Italian and Swiss borders. With one or two peaks of the Caucasus it ranks among the highest points in Europe. The celebrated *mer de glace*, one of the greatest Alpine glaciers is here, as are the Bossons, and Miage. The mountain was first climbed from Chamonix in 1786; the summit is 15,780 ft. high. See also ALPS.

**Blanc Fixe**, a popular name for precipitated barium sulphate, used as a paint pigment. See also BARIUM.

**Blanching** (cooking), the process by which an unpleasantly strong flavour is removed, or colour is improved. In each case the method is the same. The food is immersed in cold water, and brought to the boil for a few minutes. The foods usually blanched are sheep's and lamb's trotters, calf's head and feet, veal and lamb sweetbreads, celery, artichokes, small onions, and turnips.

**Blankenberghe**, popular Belgian holiday resort N.E. of Ostend. There are the usual seaside amusements and amenities. The chief local industry is fishing, and a small and well-equipped harbour serves the fleet. Pop. (1925) 7000.

**Blanketeers**, 5000 Lancashire cotton operatives who assembled near Manchester in 1817 with blankets for camping (hence the nickname) and the object of marching to London to see the Prince Regent (George IV) and obtain redress for their grievances. The leaders were imprisoned under the Combination Acts, and the rank and file dispersed, but as a result of an

interview with a Minister certain reforms were introduced

**Blank Verse** This is the name given in English to poetry written in unrhymed iambic lines of five beats each. The decasyllabic iambic line is found in a 10th-cent Provençal poem and was used by Chaucer and generally throughout W. Europe but it was always rhymed. The Italian poet Trissino was the first to dispense with rhyme in his tragedy *Sophonisba* (1515) and thus soon became the general practice of Italian dramatists. The new Blank Verse was first introduced into English literature by Henry Howard Earl of Surrey in his translations from the *Æneid* and was first used for dramatic purposes in Backville and Norton's *Gorboduc* (1562). This early blank verse was very stiff adhering rigidly to the strict succession of five iambic feet and to a certain extent this is true even of Marlowe. But Marlowe with his vivid imagination and strong emotion could not be held within such bounds entirely and he did much towards the broadening of the scope of blank verse. In Shakespeare's hands it became as need required an instrument capable of almost every expansion and adaptation and Milton's use of it with his elaborate artistry of variety precluded the possibility of its succumbing to the ever present danger of monotony. The standard of blank verse has in fact been set by Shakespeare and Milton. Others have made masterly use of this measure and have left upon it the stamp of their own individual genius but neither Dryden Wordsworth Keats Browning nor Swinburne has introduced into it anything which differs essentially from the verse used by Shakespeare and Milton. Reference may be made to *Blank Verse* by J. A. Symonds (1890) and *A History of English Prosody* by G. Saintsbury (1906-10).

**Blanquette**, see FRICASSÉE

**Blarney town** co. Cork Irish Free State noted for its castle and the blarney stone the tradition being

that whoever kisses this stone is endowed with persuasive eloquence. The legend is that Cormac M Dermot an Irish rebel having concluded in 1002 an armistice with the English on condition of surrendering the castle succeeded by his promises and entreaties in holding that stronghold until the assailants became the laughing stock of the English Court.

**Blasco-Ibáñez, Vicente** (1867-1909) Spanish novelist and revolutionary is best known for his later novels *Blood and Sand* (1913) *The Four Horsemen of the Apocalypse* (1916) and *Mare Nostrum* (1918) all of which have been successfully filmed. His earlier novels dealing realistically with the peasants and fisherfolk of his home Valencia are thought by some critics to be his best. In others e.g. *La Catedral* and *La Bodega* he developed his political views.

**Blasphemy** any profane scoffing at the Holy Scriptures or the Christian religion or denial of the existence of God. In Common Law it is a misdemeanour but the law has practically ceased to be enforced and would probably not be enforced except in cases leading to a breach of the peace.

**Blast Furnace** see IRON AND STEEL FURNACE

**Blasting** a process by which the force of explosives is used to loosen or shatter masses of hard materials. The explosive is nearly always introduced into holes drilled to a sufficient depth in the material. Drills used for this purpose are percussion drills and are generally operated by compressed air (see DRILLS). Two types of explosives are employed according to the nature of the material and the effect desired. Low explosives explode slowly gunpowder for instance at the rate of 3-4 metres per second whereas high explosives explode very rapidly blasting gelatine at the rate of 7000 metres per second. The art of blasting consists in using the most suitable explosive and above all in its application guided by experience at the most suitable point. Most rocks are fissured and the gases from the explosion penetrate

into the rock and disintegrate it along the natural lines of cleavage

**Blasting Gelatine**, a special type of explosive for use in mines. It consists of 7 per cent of nitro-cellulose and 93 per cent of nitro-glycerine, the nitro-cellulose being dissolved in the latter. *See also* EXPLOSIVES

**Blastoderm**, the layer of cells formed at one pole of the yolky egg of reptiles and birds. The yolk prevents division from taking place through the egg. At the pole containing less yolk, the ovum divides and subdivides, forming the blastoderm, which gradually spreads round the yolk and forms the embryo. *See also* EMBRYOLOGY

**Blastoids**, a group of fossil *Echino-dermata* (*q v*) confined to the Palæozoic era. They were stalked forms, attached to the sea floor, and probably resembled the modern sea lilies (*q v*) in appearance and method of feeding. The group arose in the Silurian and died out at the top of the Carboniferous, and, though numerous at times, are not very important geologically.

**Blastula**, a hollow sphere of cells formed after a series of divisions of an ovum of a multicellular animal. In such very yolky eggs as those of reptiles and birds, and in the development of the ova of mammals, the central cavity is not formed, and there is no true blastula. *See also* BLASTODERM, EMBRYOLOGY

**Blatchford, Robert** (b 1851), English journalist, is well known for his socialistic, agnostic, patriotic, and spiritualist contributions to the popular press. In 1891 he founded the *Clarion*, a Socialist periodical. His best-known books are *Merric England* and *God and My Neighbour*.

**Blavatsky, Helena Petrovna** (1831-1891), known as Madame Blavatsky, a Russian, founded the Theosophical Society in 1875 in New York, and attempted to gain converts by means of spiritualist phenomena. Although the genuineness of these phenomena was called into question, she remained the leader of the Theosophists.

**Blau** [*pron* blou] Gas, an artificial

illuminating gas, manufactured by decomposing mineral oils in retorts by heat, and compressing the resulting gas till it liquefies, it is transported in this condition, and on releasing the pressure assumes again the gaseous state, in which form it is utilised both for heating and lighting. It is very similar to Pintsch gas (*q v*) and is, like the latter, used for the illumination of railway carriages. *See also* AIRSHIPS.

**Blazon**, in heraldry, the composition of a coat of arms. *See also* HERALDRY

**Bleaching** is any process by which colouring matter is rendered colourless and/or removed from liquids or solids used in industry. The processes used may be divided into four classes: (1) reduction of the colouring matter by some chemical process in which "nascent" hydrogen is produced, (2) oxidation processes, by which nascent oxygen is produced, (3) the action of light of all kinds, (4) adsorption. The last process is only applicable to liquids, and is described under COLLOID CHEMISTRY.

The chief reducing agents employed technically are sulphur dioxide ( $\text{SO}_2$ ), forming with water sulphurous acid, ( $\text{H}_2\text{SO}_3$ ), and its compounds. The gas is generally prepared by burning sulphur or iron pyrites. It is easily condensed by pressure to a liquid, and may be obtained liquefied in glass vessels like soda-water siphons. It reacts with chlorine and can thus be used to remove traces of chlorine after the latter has been used for bleaching purposes, and hence it and its compounds form the basis of "anti-chlor" s.

The most important oxidising agent used in bleaching is chlorine, a greenish-yellow gas with a very strong smell, and easily liquefied by cold or pressure. It is a product of the electrolysis of common salt in the manufacture of caustic soda, and is therefore available in enormous quantities, a major problem of chemical economics being to find a sufficient commercial use for it. It is now supplied in liquid form in cylinders. *Bleaching powder*, so-

called chloride of lime is formed by the action of chlorine gas on slaked lime and probably consists of a compound of calcium chloride and calcium hypochlorite  $\text{Ca}(\text{OCl})\text{Cl}$ . It is a white powder which is not deliquescent nor soluble in alcohol and hence cannot contain calcium chloride. It deteriorates rapidly when exposed to air.

Sodium hypochlorite may be prepared by the action of chlorine on caustic soda solution or solution of sodium carbonate. It is known by various names such as *Eau de Javelle*, *Dakin's Solution* and *Eusol*.

These chlorine bleaching solutions are characterised by their available chlorine in other words the amount of chlorine liberated by decomposing 100 grammes of material with excess acid. Commercial bleaching powder contains about 36-38 per cent of available chlorine but the highest quality may contain as much as 43 per cent.

Bleaching powder and hypochlorite cannot be used for bleaching animal fibres but are always used for cotton; they are also used in laundry work to remove stains. Acids are not used as aeration of the liquor being sufficiently effective and safer. Chlorine and lime must of course be completely removed from the finished goods.

Hydrogen peroxide  $\text{H}_2\text{O}_2$  is a valuable bleaching agent which may be used for wool and silk. It is unstable in concentrated solution but keeps well in dilute solution in water especially if certain catalysts (see CATALYSIS) are excluded and certain stabilisers such as phosphoric acid, glycerine, naphthalene or very dilute sulphuric acid are present. Its value is stated in terms of the volume of oxygen gas which 1 volume of the solution will yield. We meet with 10 to 12 volume and 100 volume peroxide the latter being also known as *perhydrol*. In order to develop its bleaching action a mild alkali is necessary, ammonia, sodium silicate and sodium phosphate being used. The further addition of a colloidal substance called an anticatalyst prevents wasteful

generation of oxygen. Sodium silicate combines both functions and blue soap, magnesium oxide and other substances are also used. These probably form unstable peroxide. Further bleaching agents acting by oxygenation include sodium peroxide, sodium perborate and ozone.

Cotton is bleached on a very large scale the goods being generally treated in piece form though yarn also is bleached. The goods are made into a rope which passes continuously through the various processes. They are generally steeped in water a process which may be continued until fermentation sets in whereby starch and other foreign substances may be removed. Diastase (see FERMENTATION) is added to promote the fermentation. The next process is *lye boiling* or *bowking* the goods being treated with a boiling solution of an alkali whereby oils, waxes, proteins, pectoses and other impurities are dissolved and dirt is loosened and washed away. The process is performed in steel vessels called *keirs* which are sometimes constructed so as to stand high pressure and hence allow of working at a temperature exceeding boiling point. Both caustic soda and lime are used as alkalis in this process. Certain waxes are not removed by lye boiling and the use of organic solvents to remove them is developing.

The bleaching process proper or *chemicking* is carried out in a tank made of stone or wood the chemick being pumped from the extracting tank, in which it is prepared if bleaching powder is used. The bleaching is effected by the gradual action of carbon dioxide from the air which is so gentle as to prevent too powerful action. The goods are then washed immediately and soured in a bath of dilute sulphuric or hydrochloric acid to remove the calcium carbonate left in the goods during the bleaching process. When sodium hypochlorite is used souring is not necessary but is often performed.

Potassium permanganate is an excel

lent bleach for cotton, the brown manganese oxide produced being afterwards removed with hydrogen peroxide and a little acid

Wool requires *scouring* before bleaching, a process which consists in the removal of the various impurities (1) "suint" or dried perspiration, (2) wool fat or lanoline, (3) dirt, (4) vegetable impurities. The suint is soluble in water, the wool fat is not. The latter may be removed, either by saponification with alkali followed by washing, or by *scouring with soap*, whereby the fat is emulsified, or finally, by means of an organic solvent. The *wool fat* or *lanoline* is a very valuable substance

In the *solvent process*, which is less injurious to the fibre, and enables an easier recovery of the fat, the process of "de-greasing" is carried out first. This is a process essentially identical with *dry cleaning* (*qv*), the solvent generally used being petroleum ether

Wool is usually bleached with sulphur dioxide, sulphuric acid, or hydrogen peroxide, but the first has the drawback already named, that the colour is gradually regained by exposure to air. Hence, peroxide is used for the higher classes of goods. Permanganate may also be employed, costing more than sulphur dioxide and less than hydrogen peroxide

*Silk* contains very little fatty and mineral impurities, but a characteristic substance called *sericin* or *silk gum*, which is similar in its nature to gelatine. This is generally removed from the silk by "boiling off," but the silk is sometimes used in the raw state, being afterwards boiled off if required. *Sericin* is soluble in hot soap and water, to which a mild alkali is sometimes added. This process is also known as *de-gumming*.

The *fibrin* or pure silk fibre left after de-gumming is nearly white, and need only be bleached when required to be white, or for dyeing with light or bright colours. Sulphur dioxide, bisulphite, hydrogen peroxide, and permanganate of potassium, are all

used for bleaching. Bleaching with sulphur dioxide is called "stoving", as in all cases where this agent is used, the colour tends to return by the action of the air. This colour being yellow, such bleached goods are generally tinted with a violet dye, which neutralises the yellow

The oldest bleaching agent is *sunlight*, and this is still employed in bleaching linen, which is made of flax. The raw flax fibre is brownish in colour, but after bleaching by methods similar to those used for cotton, it is white. The best linen is "grassed," that is to say, exposed to the action of sunshine, air, and moisture, which when continued sufficiently long, bleaches the linen with the least possible injury to its strength. *Ultra-violet light* (*qv*) is an exceedingly powerful bleaching agent, and the action of sunshine is probably largely due to this

Consult S R Trotman and E R Trotman, *The Bleaching, Dyeing, and Chemical Technology of Textile Fibres* (London, 1925)

**Bleaching Powder**, chloride of lime, used for bleaching (see CALCIUM, BLEACHING).

**Bleeding**, see FIRST-AID

**Blenheim**, Bavarian village on the Danube, celebrated for the victory of English and Austrian troops under the Duke of Marlborough over Allied Bavarians and French, Aug 13, 1704. For this service to the nation a palace was erected in Oxfordshire by Parliament for the Duke, and named **Blenheim Palace**

**Blenny**, small fish found mostly in rock-pools, and usually provided with spines in the dorsal fin and tentacles over the eyes

**Blepharoblast**, see CELL

**Blériot, Louis** (b 1872), French aviator, is famous for his cross-Channel flight (the first) in 1909, and for his invention of the light monoplane

**Bligh, Wm.** (1754-1817), English admiral, sailed with Cook in the Pacific, sent to introduce bread-fruit

into the W Indies (1787) but a mutiny on his ship *Dowry* was successful, and Bligh and his officers drifted 4000 m. in an open boat before reaching land. He fulfilled his mission in the '90s. Was Governor of New South Wales (1805-9) imprisoned during another mutiny and returned to England 1811

**Blind, Care of.** There are approximately 45 000 registered blind persons in England and Wales of whom 2500 are children. In 1885 a Royal Commission enquired into the facilities for training and employing the blind and the workers petitioned without success for a subsidy of wages. In 1910 the National League of the Blind again drew public attention to the need and its workshops secured Government contracts for brushes etc. These however were only executed at a loss and in 1914 a governmental committee was set up to consider the conditions. As a result of their report a central body was formed under the Ministry of Health which issued grants totalling £70 000 in 1921-2 to blind persons at 50 and to local authorities maintaining workshops homes etc.

From 1885 onwards pre-school elementary and secondary education has been provided for blind children. Higher education for potential typists, school teachers and musicians is provided at the Royal Normal College for the Blind. Higher education is placed on the charge of the local education authorities by the Education Act of

1900. The National Library for the Blind founded in 1882 contains nearly 400 000 volumes (including music) in Braille (q v) and Moon types. Two inspectors of the Welfare of the Blind are attached to the Ministry of Health. The survivors of the 4000 British soldiers blinded in the Great War are treated, taught and cared for in the St Dunstan's Hostel founded by the late Sir Arthur Pearson. The National Institute for the Blind with its headquarters at 224 Great Portland Street also runs several homes and hostels, a School of Massage, a College for Blind Girls, a Special School for Blind Children and Sunshine Homes for Blind Babies besides carrying on a large Braille and Moon publishing business.

In the United States education has been provided for the blind since 1879, a Federal grant being also made for the printing of embossed textbooks. Private schools had however existed since 1830, the oldest founded in Boston having recently given much thought to the difficult problem of teaching blind deaf mutes. Scholarships for blind university students are provided in 9 States.

**Blindworm,** also known as the slow worm, a legless snake like lizard common in Great Britain and Europe generally. It is wrongly regarded as blind because its eyes are rather small. The name blindworm has also been applied to a worm like amphibian.

**Blister** an accumulation of serous fluid under the superficial layer of the skin caused by rubbing, burn, or the use of vesicants (blistering preparations) and occurring in certain diseases e.g. smallpox and chicken pox. An efficient treatment of foot blisters consists in washing them thoroughly in water to which a little disinfectant has been added, pricking and allowing the fluid to escape and subsequently covering with animal wool which has been smeared with boracic ointment.

A modern method of treatment for blisters acquired by burning is to apply a tannic acid preparation and



Blénot.

cut away the skin destroyed by the accident

Blisters caused deliberately by vesicants as a means of counter-irritation are, unless specially directed to the contrary, covered with a layer of cotton-wool until the serum is absorbed

**Blister Beetle**, a name applied to the "Spanish fly" of S Europe and related forms. They are true beetles, and produce the irritant principle cantharidin, which is extracted from the front wings. See CANTHARIDIS, OIL or

**Blockade**, in times of war, the blocking by men-of-war of the approach to the enemy coast, or a part of it, for the purpose of preventing ingress and egress of vessels of all nations. It differs from siege in that its sole purpose is the interception of all intercourse between the blockaded coast and the world at large, whereas siege aims at capture of the besieged place. See also DECLARATION OF PARIS

**Block-book**, book produced by engraving slabs of wood in whole pages and then printing off from them. This method was used before the introduction of movable type, especially for producing illustrated books, and is still in common use in the Far East

**Bloemfontein**, capital of the Orange Free State, situated c 500 m W of Durban. It is an important agricultural centre and holds annual sheep and cattle fairs that rank among the most important in S Africa. Pop (1931) (European) 28,000, (native) c 20,000

**Blois**, town, capital of Loir-et-Cher, France, pop 23,900, an attractive centre for tourists, with many places of beauty and interest. Its industries are small but increasing, particularly its wine and timber trade, although the more staple business is in gloves and porcelain. The Romans erected a fine aqueduct there. By order of Henry III, the Duke of Guise was assassinated here, and Mary de Medici imprisoned in the castle in 1617. The beautiful chateau was once the residence of French kings

**Blok**, Alexander A. (1880-1921), Russian poet wrote one of the greatest poems which the 1917 Revolution inspired, *The Twelve*. Previously he had written love poems and some bitter satires (*Nocturnal Hours* 1911)

**Blomfield**, Sir Arthur William, F R I B A (1829-1899), English architect and President of the Architectural Association (1861). Among the buildings designed by him are Sion College Library, the Law Courts (with Street), several churches, and restorations to four cathedrals, including Canterbury.

**Blomfield**, Sir Reginald Theodore (b 1856), English architect, designed the Lady Margaret Hall buildings at Oxford, the new bridge at Stratford-on-Avon, and the Menin Gate at Ypres. He was knighted in 1919.

**Blondel**, Richard I's musician, who is fabled to have discovered where the King was imprisoned in Austria by playing music outside a castle, and recognising his voice singing to the music (1193)

**Blondin**, Charles (1824-1897) (Jean François Gravelet), famous tight-rope walker, born at St Omer, attained great celebrity by crossing the Niagara on a rope 160 ft above the water (1859). This feat he performed many times under various conditions, blindfold, pushing a wheelbarrow, etc. He last performed in 1896

**Blood**. The article on the CIRCULATORY SYSTEM (*qv*) explains the functions of the blood when it circulates in the human body, this article is concerned with how these functions are performed

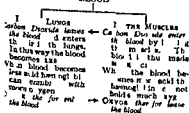
Blood is a complex substance consisting of blood cells, corpuscles, floating in a watery fluid serum. The blood consists half of serum and half of corpuscles

The corpuscles are of two main types, red and white. There are nearly a million red corpuscles to every thousand white. The red corpuscles are all alike, and contain a substance called hæmoglobin. The white corpuscles, on the other hand, are of several types, and each type

appears to have a particular function to perform in the body

The hæmoglobin in the red blood cells is able to combine with oxygen in very large amounts and the blood is therefore able to carry oxygen from the lungs in considerable quantities. When the blood arrives in the muscles it receives into it the waste products of muscle activity the chief of which is carbon dioxide ( $\text{CO}_2$ ). When this dissolves in the blood it forms carbonic acid by combining with the water of the blood serum ( $\text{CO}_2 + \text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{CO}_3$ ). In this way blood arriving in muscles is always being made more acid and in fact the more work the muscle is doing the more carbon dioxide it is producing and the more acid it is rendering the incoming oxygen laden blood. The capacity of hæmoglobin to combine with oxygen varies. In neutral solutions we may say it combines with much oxygen but when the solution is made acid it will not combine with so much. If it is in combination with oxygen when the solution is made acid then it liberates some of that oxygen and this is what actually happens in the muscles. As a result the oxygen leaves the blood and enters the muscles. The blood then returns to the lungs where carbon dioxide diffuses out of it into the air in the lungs. The blood becoming less acid it once takes up more oxygen and the cycle begins again.

#### BLOOD



Another very important function of the blood is the carriage of sugar and it is therefore of interest to consider

the actions regulating the sugar content of the blood

The article on the DIGESTIVE SYSTEM explains that it is only a very simple sugar that can diffuse through the wall of the alimentary tract into the blood stream. Consequently all the complicated sugars are held up in the alimentary canal until they have been broken down or digested into a simple sugar namely glucose. In the form of glucose sugar readily dissolves in the blood serum and is carried to the liver there to be converted by a secretion in the liver cells to a more complicated sugar called glycogen. This complicated sugar will not dissolve in the blood serum and it is therefore conveniently left behind in storage in the liver cells.

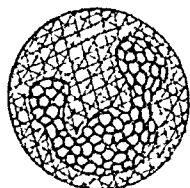
The process is reversed when the muscles require sugar to do work. Nervous impulses and a secretion called adrenalin act on the liver cells and break down the glycogen again into glucose which of course at once dissolves in the blood serum and is carried to the muscles. These muscles have used up what glucose they already possess and consequently the glucose in the blood is in greater concentration than in the muscle cells. It therefore readily diffuses into the muscle cells where it is burnt and leaves room for still more glucose to diffuse from the blood. When the muscular exercise comes to an end the nervous impulses stop going to the liver and no more glycogen is broken down and so the glucose supply to the blood passing through the liver ceases. From this it will be clear that the chief factor controlling the amount of glucose in the blood is the nervous impulses travelling to the liver cells. This process is explained more fully under LIVER.

The chief factories of blood formation are the bone marrow and the lymph glands. The chief places of destruction are the spleen and the liver.

The marrow manufactures red blood corpuscles and one type of white

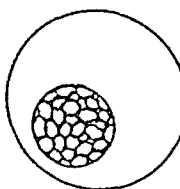


corpuscles known as *myelocytes*. The lymph glands manufacture the other type of white corpuscles, namely, the *lymphocytes*. The red corpuscles are small and have no nuclei. They contain all the hæmoglobin, and their

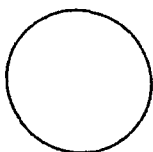


*Myelocyte*  
Lobed nucleus with granules formed in marrow. Devours micro-organisms and foreign bodies in both blood and tissues.

WHITE  
BLOOD  
COR-  
PUSCLES  
  
LEUCO-  
CYTES



*Lymphocyte*  
Round nucleus, no granules formed in lymph glands, contains substance harmful to micro-organisms.



Red blood corpuscle—no nucleus—formed in bone marrow. Contains hæmoglobin, which carries oxygen.

chief function is to carry oxygen. The white corpuscles, on the other hand, all contain nuclei. In the lymphocytes, manufactured in the lymph glands, the nuclei are round, and contain no granules; in the myelocytes, manufactured in the marrow, they are lobed or horse-shoe shaped, containing granules.

The myelocytes act as the scavengers of the blood. They devour bacteria and foreign particles in the bloodstream and in the tissues, a process known as *Phagocytosis*. We find that when the body becomes invaded by bacteria there is a great increase in the number of both types of white cells, and it appears that the lymphocytes

manufacture or contain substances which are harmful to bacteria.

Two very important contents remain to be mentioned. The first is a soluble substance contained in the serum, called fibrinogen. The second is an organised structure analogous to a blood corpuscle, which is called a platelet. These platelets are present in varying numbers and are very small in size. They are very fragile, and when they break down they liberate a substance called thrombokinase. Their importance lies in the fact that they play an essential part in producing clotting of the blood. When the skin of the body is cut or pricked and a small blood-vessel is opened so that bleeding takes place, the blood platelets coming in contact with the damaged tissue immediately break down and liberate thrombokinase. When this substance mixes with the fibrinogen dissolved in the serum, then the fibrinogen is turned into an insoluble substance called fibrin. This insoluble fibrin is precipitated in the form of a mesh-work, and it entangles in it large numbers of blood corpuscles, in this way a clot is produced which plugs the open end of the damaged blood-vessel, the bleeding then stops.

People suffering from the disease known as hæmophilia find that the slightest cut or wound on the skin is followed by bleeding which will not stop. Such people have a normal number of platelets in their blood, but unfortunately their platelets are not fragile, and so do not break down when they come in contact with damaged tissue. Consequently, no thrombokinase is liberated, and the fibrinogen in the serum cannot turn into the fibrin which is so necessary for the formation of a clot; the bleeding continues unarrested.

Let us now consider another very common blood disorder, namely, *anæmia*. This condition indicates a lack of sufficient hæmoglobin in the blood, and can be produced in several ways. Either red blood cells are being

broken down by the spleen faster than they should be or they are being lost in some other way such as severe and recurrent hæmorrhage or else they are not being manufactured in the marrow at a fast enough rate. Over destruction and excessive loss produce the same result as under production. Of these three causes perhaps the most common is under production following upon deficient supply of raw materials or deficient factory accommodation in the body. Lack of raw materials to make hæmoglobin is a very common cause of anæmia. Hæmoglobin contains iron and if the diet is lacking in enough iron anæmia will follow for a certainty. Deficient factory accommodation is the other common cause of anæmia. If the bone marrow is harmed in any way as it is to some extent in any form of acute infection then the blood cells cannot be produced in normal numbers. This falling off of numbers is also produced when the bone marrow is damaged by X rays. People working in X ray departments have to watch from time to time to see that their red blood cells show no signs of falling in numbers.

In pernicious anæmia some factor necessary for the formation of red blood cells is lacking but it is not yet known exactly what that factor is.

If we turn to over-destruction we find that there is a disease known as *splenic anæmia* which is associated with a large spleen and very fragile blood cells. In this condition as in purpura removal of the spleen is often followed by a return to normal health.

When anæmia is due to continued hæmorrhagic loss of blood then it is only possible to find and cure the cause of this hæmorrhage for unless this is done the patient is sure to die.

There are conditions in which there is a fall in the number of white blood cells. In these cases as one would expect there is a lowered resistance to bacterial invasion and the outlook is very grave.

Now let us consider the opposite condition in which there is an increase

in the blood cells which may occur in any of the three main types of cell. It is probably true to say that in every case the increase is due to over production. If too many red cells are being formed we get a condition of erythræmia. The patient has a beet root-coloured face and feels very uncomfortable but his general condition can be much relieved by administering small doses of a poison such as arsenic which produce a slight reduction in the activity of the marrow.

This article would not be complete without a reference to blood transfusion. It is a complicated problem but it has been proved that we can save a life by taking blood from the veins of one person and injecting it into the veins of another. This is more fully described in the article TRANSFUSION. It is sufficient here to note that the bloods

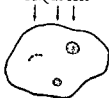
of any two human beings may not be of the same type

and if they are not the injection of one person's blood into the veins of another may be followed by fatal results. But with knowledge and care blood transfusion may prove the salvation of a precious life.

See also BONES URINARY SYSTEM  
ENDOCRINE SYSTEM

ANIMALS.—In all essential respects the blood throughout the mammalia is similar to that of man. An exception however occurs in camels and llamas in which the red corpuscles instead of being circular are oval. In this respect they resemble the red blood corpuscles of birds reptiles and typical fishes but the resemblance is only in shape because in camels as in other mammalia the red corpuscles apparently correspond to the nuclei of

BLOOD  
CORPUSCLES



A piece of amoeba that soon meets the human blood stream and is responsible for the form of dysentery

the large red corpuscles of the other vertebrate animals. The larvæ of eels are exceptional amongst fishes in having colourless blood. The lampreys (*q v*) are exceptional in having these red corpuscles circular, although in the related hag fish (*q v*) they are normal in shape.

The blood of sea squirts (*q v*) contains typical amœba-like white corpuscles and, usually, a certain number of pigmented corpuscles, brown, red, and yellow, and sometimes blue in colour, but in the lancelet and balanoglossus (*qq v*) the blood is colourless.

In typical Mollusca, such as the freshwater mussel, the blood is colourless and contains white corpuscles, but the plasma is sometimes tinged with blue, as in the snail, owing to the presence of a copper compound, hæmocyanin, which turns blue when oxidised, and has the same property as hæmoglobin. In some species of Mollusca, hæmoglobin is, however, present, and may be contained in special corpuscles, as in a species of razor shell (*q v*), or diffused in the plasma, as in a clam, known in N America from its colour as the "blood clam".

The blood of some Crustaceans (*q v*), like the lobster and crayfish, is also blue when oxidised, owing to the presence of hæmocyanin dissolved in its plasma. The corpuscles are white and the blood readily clots. In other Arthropoda (*q v*) the blood is either a colourless fluid with white corpuscles, or is coloured in various ways. Amongst the insects, for example, the "blood-worm," the larva of a midge, is reddened with hæmoglobin dissolved in the plasma, whereas in the caterpillars of certain Lepidoptera it may be yellow or green from the absorption of the colouring matter of the plants they feed upon. In the male larva of the gipsy moth the blood is yellowish, in the female green.

In some Annelids, *e.g.* the earth-worm and leech, the blood is also composed of red plasma with hæmoglobin and colourless corpuscles.

Amongst the higher groups of invertebrate animals blood with the property of clotting is also found; as in the vertebrates.

**Bloodhound**, or *Slouth-hound*, a powerful but slow hound characterised by its narrow, peaked, loose-skinned head, very long pendulous ears, lips, and dewlap, and famous for its bell-like note and power of following a cold scent. It is now an uncommon breed, but scarcely differs from the Old English Talbot hound which traced its descent from the St Hubert brought to England by William the Conqueror. These hounds were formerly used for tracking wolves, wild boars, and men, and the police now sometimes use bloodhounds for tracking criminals, but an exaggerated idea of their powers usually leads to disappointment. The hounds, mis-called bloodhounds, used for slave-tracking in N America were a distinct breed.

**Blood Root**, name applied to *Sanguinaria canadensis*, a Canadian plant with a root having a blood-red sap, used as an emetic. *Potentilla tormentilla* is also sometimes so-called.

**Bloodstone**, *see* CHALCEDONY.

**Blood-vessels, Diseases of.** For the general plan of the system *see* CIRCULATORY SYSTEM.

In the case of the arteries, some diseases cause such a rigidity of the arterial wall that the vessels lose their normal elasticity. Some take the form of arterial spasm, so that the vessels are permanently over-contracted, or may even become completely occluded. Others lead to lack of tone of the muscle in the walls, so that the vessel is over-distended, and these conditions may cause local distensions, so marked as to result in the formation of sacular out-pocketings of the artery, which may finally burst. The causes of this condition are various. On occasion, the artery wall becomes the seat of inflammation, producing the state of distension; in other instances the artery is acted upon by abnormal nervous impulses. Sometimes the cause is senile decay of the

vessel wall. Whatever the cause there is often an effect on the contained blood. This may become stagnant it may clot against the rough surface of the diseased artery wall or it may become contaminated by the entrance into it of detached pieces of artery wall. In either case the solid particle is swept on and blocks the arterial channel by becoming lodged farther on at some site of narrowing or arterial junction. This is a further complication of the original trouble.

In all people who are advanced in years the arteries tend to become hardened in patches by the deposition in their walls of calcium salts which form bony plaques. This condition is known as *atheroma*. In some cases the plaques eventually run together and the whole artery becomes rigid resulting in *arterio-sclerosis*. The condition is always associated with high blood pressure and sometimes causes hemorrhages from mucous membranes—for example nose bleeding. The blood vessels are easily broken and very severe hemorrhages may follow. Apart from this the rigidity of the vessel walls may impair the flow of blood and the tissues deprived of blood will perish. Thus gangrene of the toes is a common sequel to arterio-sclerosis. It is interesting to note that if an X ray photograph is taken of a limb in this state the arteries being full of opaque calcium salts appear very well marked on the negative—a feature of distinct diagnostic importance.

When the arterial wall is weakened so that it becomes over-dilated there is a fall in blood-pressure. This condition is met with in all cases of exhaustion or debility as for example during and after prolonged illness—or as a result of deficient food or starvation. The particular interest of this weakness in the wall for medical point of view, is in its nature of the disease in which there is a purely local dilatation of the vessel with the consequent production of an aneurysm. Aneurysms may take form in

herent weakness of the arterial wall in one place but they are more usually caused by weakness of the wall due to infection with syphilis. They are a great source of danger to life because of their tendency to burst and produce fatal internal and hidden hemorrhage.

The formation of a blood clot when the blood in the vessels comes in contact with a rough and damaged portion of the vessel wall where the lining cells which usually prevent clotting have been destroyed is called thrombosis. Its immediate effects are local—the cutting off of the blood supply of the tissues drained by the artery concerned. Portions of the clot may however become detached and be washed along in the blood stream. Particles of the blood vessel wall may also become detached and carried away in the blood flow. These particles in the blood stream are called emboli; they are not necessarily always solid but may be bubbles of gas. If a vein is cut during an injury so that air is admitted the air bubbles in the blood stream produce the same effects as other kinds of emboli. In any case the emboli are swept along in the blood and eventually lodge at some natural point of constriction. Very often this point is in the blood capillaries of the brain. The blood-supply to the brain is then cut off resulting in loss of consciousness known as apoplexy.

The veins are also subject to thrombosis like the arteries. Like the vessels of the lymphatic system (qv) the veins frequently contain bacteria which have been drained from their site of entry into the body. Thus venous thrombi are very often the result of gross bacterial infection and the clots are truly latent bombs. For if one small piece of the bacteria laden thrombus becomes detached and washed away as an embolus it reaches the general circulation and spreads the infection rapidly throughout the body.

In the disease of the veins they have lost

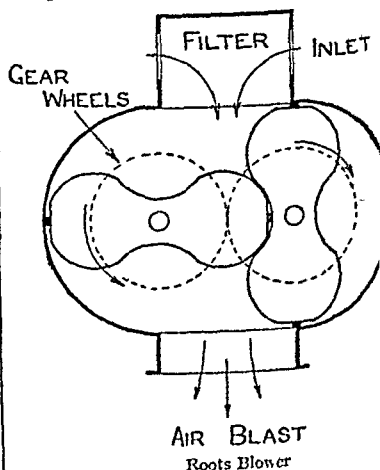
their tone, and the valves in them have become damaged so that blood is not held up, instead, it tends to surge backwards and distend the weakened vein below. The condition is almost certainly partly due to bad living and lack of attention to personal hygiene—a bad state of the blood leads at once to a bad state of the vein walls. Apart from this, there is no doubt that occupations which involve standing for long periods place a strain upon the veins, which also promotes the disease. It is also a frequent accompaniment to pregnancy. The treatment is very difficult and is often not very successful. Supporting bandages on the leg provide some degree of mechanical aid, but the real cure must come from within. Good food, not in excess, and regular habits, with plenty of bodily rest, are essential if a permanent cure is to be ensured.

**Blood-Worms**, the larvæ of several species of midge (*qv*) found in the mud of freshwater ponds or pools. They form useful food for aquarium specimens, because they are easily seen, owing to their colour, which is caused by hæmoglobin in the blood.

**Bloomer**, Amelia Jenks (1818–1894), is famous for having given her name to a type of feminine trousers, which she invented as a measure of dress-reform for women. She was a prominent American champion of women's rights, and a zealous temperance reformer.

**Blowers** or *Blowing Engines* are machines for producing a large output of air under low or moderate pressure. A large variety of principles is brought into use for this purpose. The commonest of all is the impeller fan, used as an air exhauster in the ordinary domestic vacuum-cleaner. The pressure thus obtainable is limited, and the fan is only really efficient at pressures of a few inches of water. Where higher pressures are needed, a very wide use of the Roots Blower is made, especially for small units. This is a special form of the cog-wheeled pump (*qv*), consisting of two blades of dumb-

bell section which are mounted on parallel shafts in a chamber, the shafts being geared together by toothed gearing outside the chamber. It will be seen from the figure that the two blades can rotate and yet remain always in contact, the air being thus continually entrapped and forwarded from the upper inlet through the blower and out through the lower delivery pipe. Piston pumps (see **PUMP-COMPRESSED AIR**) are used to some extent for low-pressure duty, but the most suitable apparatus for large low-pressure delivery is the turbo-



blower, which is really a steam turbine reversed in direction. It is frequently also driven by a direct-coupled steam turbine. Its advantage in efficiency lies in the fact that the compression is accomplished in stages, five being a common number. Such blowers may deliver up to 100,000 cu ft. of air per minute, compressed to a pressure of about one or even more atmospheres. Such large blowers may need as much as 10,000 horse-power to drive them.

**Blow-flies** are true flies, and are also known as blue-bottles and green-bottles, the former being metallic blue and the latter emerald green in colour.

They lay their eggs in meat carcasses or other animal matter for their larvae to feed upon. In this way the maggots are beneficial scavengers and as gentles are used for feeding in sectivorous cage birds. But the flies themselves may be carriers of disease germs on their feet and should be killed at once. A species akin to the green bottle is a serious pest to farmers by laying its eggs in the fleeces of sheep the maggots if undetected causing the death of the sheep.

**Blown Oils**, a term applied to certain fatty oils after they have been heated and agitated by air oxygen or ozone. The effect of this treatment is to oxidise certain constituents of the oils with the result that a considerable increase in density and viscosity occurs. The oxidation is usually assisted by the presence of small amounts of catalysts known as driers mostly compounds of manganese or cobalt. Blown oils of which linseed is one of the principal are used chiefly in the manufacture of varnishes. See also OILS, FATS AND WAXES. CATALYSIS.

**Blow pipe**, apparatus used for driving a jet of air or oxygen into a flame of burning gas oil or wax. Blow pipes in which the gas or vapour supply is combined with the air supply are used for brazing and other work. Blow work or glass blowing and for welding by means of oxyacetylene and will be found described under these headings. The mouth blow pipe consists of a simple brass tube bent at right angles at one end and there fitted with a jet. This is used by the chemist and particularly the prospector for carrying out the blow pipe reactions described under ANALYTICAL CHEMISTRY. Its use requires some skill in obtaining both oxidising and reducing flame at will.

**Blow pipe Soldering** see BRAZING AND SOLDERING.

**Blücher** Gebhard Leberecht, von 1774-1819) Prussian military commander Prince of Wahlstadt. Blücher resigned from the Army in 1773

rejoined it in 1787 and fought through the Napoleonic Wars. He was defeated at Ulsterstadt (1806) commanded the victorious Allies at Leipzig (1813) and after Napoleon's return in 1816 was defeated at Ligny just before his march to Waterloo where his arrival turned the tide against the French. Blücher entered Paris with the Allies but retired to Silesia in 1815 where he died 4 years later.

**Blue** the name given to an Oxford or Cambridge undergraduate who represents his university at one or more of the recognised inter university athletic contests e.g. rowing cricket football etc. from the colours which he is entitled to wear: e.g. dark blue at Oxford light blue at Cambridge. For certain contests only a half blue is awarded.

**Bluebeard**, the fabulous miscreant who killed his successive wives and hid their bodies in a locked room and was finally destroyed through the ingenuity of his last wife. His first appearance in literature is in one of the *Contes* (1697) of Perrault entitled *Barbe Bleue* but he had been known to folklore long before that.

**Bluebell** (or *Wild Hyacinth*) (*Scilla maritima*) a familiar low growing plant of the family Liliaceae common in woods and hedges and characterised by its pale blue or purple bell-shaped flowers borne in an elongated cluster at the top of a long stalk and its strap-like leaves which radiate from the top of the bulb and surround the flower stalk. It is perennial and flowers in May and June. The Scotch bluebell or harebell belongs to the family Campanulaceae and the appearance and arrangement of its flowers somewhat resemble that of the true blue bell but its flower-stalk is very slender. It flowers in late summer.

**Blueberry**, see VACCINIUM. Also the fruit of the Blueberry Tree (*Myoposum Serratum*).

**Blue Bird**, a N. American bird with a blue back and a chestnut breast. It is related to the warblers and thrushes.

**Blue Books**, popular name for the official documents and reports issued by the Stationery Office at the order of the British Government from the colour of the paper in which they are usually bound. Although reports of proceedings in Commons have been printed since 1681, they have only been sold to the public since 1836. To-day the sale of the reports of Royal Commissions and the researches of Government departments provide a considerable contribution towards the original costs.

**Bluebottle**, see BLOW-FLY

**Bluecoat School**, see CHRIST'S HOSPITAL

**Bluefields**, chief port of Nicaragua, on the Caribbean. There is a considerable trade in agricultural produce, live stock, and gold, all of which are produced inland. Manufactured goods are imported, and Bluefields is a port of call for coasting steamers. Pop. 5000.

**Blue Grass** (*Poa pratensis*) one of the meadow grasses. Also an ornamental grass for garden use, with bluish seed spikes.

**Blue Gum** (*Eucalyptus globulus*), the Australian gum tree, with bitter, astringent leaves.

**Blue Mountains**, The - (1) part of the Great Dividing Range of Australia in New S. Wales. (2) A lofty range running from E to W in Jamaica. (3) Part of the Appalachian system in Pennsylvania, U.S.A. (4) A minor range of the Rockies in the E. of the State of Oregon, U.S.A.

**Blue Mud**, see MARINE DEPOSITS

**Blue Shark**, a slate-coloured shark, 12 ft. or more in length, which sometimes visits the British coasts, and may prove dangerous to bathers.

**Blueskin**, a one-time accomplice of the felon, Jack Sheppard (qv). When on the scaffold he attempted to murder Jonathan Wild with a hidden knife.

**Bluestocking**, a term denoting a learned woman, with some connotation of pedantry. Boswell relates that in 1781 certain literary clubs came into

existence, to which both sexes were admissible, and that a prominent frequenter of these was one Mr. Stillingfleet, who wore blue stockings. It may be thought there is no certainty about it, that this was the origin of the term. It has been adopted in France in the translation *Bas bleus*.

**Bluethroat**, a bird related to the nightingale and redstart. It is a migratory species, wintering in N. Europe and Asia, and may be known by its blue throat, which bears a white or chestnut spot.

**Blum, Léon** (b. 1872), French writer and politician, born in Paris. After acquiring a reputation as a newspaper critic, he joined the Socialists in 1899, and was elected deputy for Seine in 1919. He formed a Left Bloc in 1921, attacked Poincaré and Millerand, and played a prominent part in the Herriot Ministry of 1924-5.

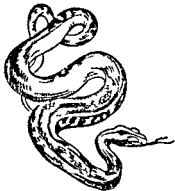
**Blunden, Edmund** (b. 1896), English author, was professor of English at Tokyo University (1924-27), and was appointed Tutor in English literature at Merton College, Oxford, in 1931. His works include *Poems* (collected 1930), and many important critical works, among the latter are *Nature in English Literature* (1929), *Shakespeare's Significance* (1929), *Life of Leigh Hunt* (1930), and others. He is the author of one of the best known War books, *Undertones of War* (1928), and edited the Oxford edition of the poems of John Clare.

**Blunderbuss** (from Dutch, *donderbus* "a thunder-gun"), a short wide-bore gun, used in the 17th cent., which could be stuffed with ball or slugs. Its discharge covered a wide area at close range.

**Blunt, Wilfrid Scawen** (1840-1922), poet and traveller in Africa and the East, was the author of many political works on E. questions, as well as of several volumes of verse. The best known of the latter is *The Love Sonnets of Proclus* (1880). Interesting memoirs of the people of his time are found in *My Diaries* (1919 and 1920).

**Boa**, or **Boa Constrictor**, one of the

largest and handsomest of the American snakes although seldom exceeding



Boa Constrictor

1 ft. in length. It is not poisonous and kills its prey by constriction. It is related to the Anaconda (q.v.).

Boabdil (*Abu Abdallah*) last Moorish King of Granada taken prisoner during an attack on Castile (1483) and was defeated at the capture of Granada in 1492 by the King of Castile.

Boadicea, Queen of the Iceni rose against the Romans and at the head of a vast army of Britons sacked Camelodunum (Colchester) and took Londinium and Verulamium (St Albans). She was crushingly defeated by the Romans under Suetonius Paulinus (c. A.D. 60) probably at a point a little S. of Verulamium. 80,000 Britons are stated by the Romans to have been slaughtered and Boadicea herself is said to have committed suicide.

Boar see Pig

Boarding house, a house not being an inn or hotel at which persons are furnished with board and lodging. The keeper of a boarding house implicitly undertakes that the lodgers are reasonably fit for habitation. His legal position differs from that of an innkeeper in that he does not hold himself out for common public employment and is therefore at liberty to reject without

reason any person applying for accommodation. Further he is not subject to the legal liability of an innkeeper for the property of guests. The landlord of a boarding house has a *lien* (q.v.) on his guests' property for any money owing.

Board of Education, the central authority for education established 1899 to supersede the Education Department of the Privy Council. Its policy is directed by the President assisted by a Parliamentary Secretary. There is a consultative committee consisting of eminent men and the representatives of organisations interested in education.

Board of Trade, formerly a committee of the Privy Council. In the 18th cent. a Trade Council was appointed in its stead; this is now a State Department and its President is invariably in the Cabinet. It has important duties in connection with commerce generally, the collection of statistics at home and abroad, registration of partnerships, business names, newspapers, regulation of sea fishing, pilots, supervision of lighthouses and various functions in connection with industry etc.

Board of Trade Unit, see ELECTRICAL MEASURING INSTRUMENTS

Boat, a small open vessel propelled by sail or small motor as opposed to the ship or larger vessel. The boat is a descendant of the primitive hollowed tree and the skin stretched over a frame of wicker. A gradual merging of the two principles evolved the modern boat in which a wooden framework is built on a keel piece and covered with planks either flat (carvel built) or overlapping (clinker built).

Bobolink (or *Icterus b. r.*) a N. Am. can. passerine bird distinguished by its stout long-clawed feet, long pointed wings and short conical beak. It is especially common in the United States in summer but winters in Central America and the W. Indies returning in vast flocks in the spring. As the birds pass N. they emit a concerted song resembling a mellow metallic clinking.



but on the S journey in Sept they are songless. They feed on rice and other grain, and do considerable damage to the crops. They make a nest of dry grass on the ground, in which the hen lays 4 or 5 eggs.

**Boccaccio, Giovanni (1313-1375)**, Italian author of the *Decameron*. He wrote prose novels, and a romance *Teside*, from which Chaucer drew his Knight's Tale of Palamon and Arcite. But his greatest work was the *Decameron* (1344-50), a collection of stories, supposed to have been told by a company temporarily exiled from Florence by the plague of 1348. It had an extensive influence on European literature, and became the source for many poems, plays, and novels of all types and ages. Its charm lies in its self-sufficiency.

**Boche**, a term of contempt applied by the French to Germany and Germans, especially in the World War. Its origin is doubtful.

**Bochum**, German industrial town in Westphalia, between Essen and Dortmund. It lies within the Ruhr basin, has large iron and steel works, and considerable coal-mining interests. Pop 322,700.

**Böcklin, Arnold (1827-1901)**, a Swiss painter, born at Basle. He began to study painting at Düsseldorf in 1846, and worked later in Antwerp and Brussels and Paris, and went to Rome in 1850, where he remained for some years. After holding a professorship at Weimar for 2 years, he returned for some time to Switzerland, and finally settled near Florence 3 years before his death. His most famous picture is his *Isle of the Dead*, which was highly popular in Germany.

**Bode, Johann Elert (1747-1826)**, German astronomer. Self-educated, he first gained fame by an elementary astronomical text-book. In Berlin, where he went in 1772, he founded the *Astronomisches Jahrbuch* (1774), and was made director of the observatory. He is remembered mainly for his law (called *Bode's Law*) for the calculation

of the relative distances of the planets from the sun.

**Bodensee**, see **CONSTANCE, LAKE**.  
**Bodh Gaya**, Indian village in Bil and Orissa, a few m. S of Gaya. It is the Mecca of the Buddhist world, and the sacred tree beneath which Buddha received enlightenment grows here. A temple was erected on the spot c 510 B.C., of which some of the outer stone railings and the diamond throne still exist. It was later placed by the present temple, which was restored by the local Government in the late 19th cent.

**Bodin, Jean (1530-1596)**, French political philosopher. His *La République*, which recognises a limited monarchy only, and the family as the corner-stone of the State, laid the basis of the science of political economy.

**Bodleian Library, Oxford**, founded by Humphrey, Duke of Gloucester, son of Henry IV, was built between 1445-1455. In 1550 the King's Commission despoiled it of books, and it was remantled in 1556 by the University. Thomas Bodley (1545-1613), who had been sent on several embassies to Queen Elizabeth, restored and endowed it richly, and presented it to the authorities with a collection of books valued at £10,000. The new building was completed in 1602. Thirty years later a new wing was added. The library contains valuable MSS from the 11th to 15th cents, exquisite illuminated missals, examples of early printing, notebooks used by Edward VI and Elizabeth, the Shelley Collection, presented in 1893, and personal relics of Milton, added in 1905. Altogether c 1 million works, and c 25,000 manuscripts, are housed in it. The first catalogue was compiled by Dr James in 1605.

The Bodleian enjoys the right to a free copy of every book published in this country.

In 1929, an additional building was set up near the Bodleian, and a statue of Bodley at Jordan Hill.

**Bodmin**, county town of Cornwall, situated c 10 m W of Liskeard.

large market town with a considerable trade in agricultural produce here are no manufactures of importance. St. Petrock's Church has ancient portions and there are parts of a 13th-cent Priory. A few Roman remains have been found in the district. The town dates from before the Conquest. Pop (1931) 85-8.

**Boece, Boyce, or Boethius, Hector** (1465?-1536?) Scots historian wrote a Latin *Scotorum Historia* (16<sup>th</sup>) a romantic celebration of Scottish great men, less historical and legendary after the style of Livy. It was translated into Scottish and Holinshed used it for his *Chronicle*.

**Boehm, Sir Joseph Edgar Bart.** (1834-1890) sculptor born at Vienna. He became R.A. in 1882 being already sculptor in ordinary to the Queen at that date. The statue of Carlyle on the Chelsea Embankment the monument to Dean Stanley in Westminster Abbey and the equestrian statue of the Duke of Wellington at Hyde Park Corner are examples of his work.

**Boehme (or Behmen) Jacob** (1575-1634) German mystic born at Altdorf, a shoemaker by trade. As a boy he had strange mystical experiences and in 1616 published *Aurora* his first book, an explanation of universal origins. His other chief work is the *Signature of All Things*. His writings brought him into conflict with the secular authorities but after examination before the Elector of Saxony he was unmolested until his death. He gained many disciples in his lifetime and his ideas exerted considerable influence on William Law and Isaac Newton (qv) among others.

**Boeotia** [BEO-SIA] mountainous district in the middle of Greece W. and N. of Attica, with which it now forms a department. In ancient times the district was the principal seat of Theban power. The natives were a byword with the cultured Athenians for rustic dulness but Pindar, the lyric poet, was a Boeotian and their military capacity was above reproach.

The historian Plutarch was a native of the district. Pop c 794 000.

**Boeotian League**, a loose federation of cities in Boeotia, a district in Central Greece whose principal town was Thebes. The Boeotian League under Thebes assisted the Persians during the Persian Wars and was defeated by the Athenians. During the Peloponnesian War (qv) Thebes and the majority of the Boeotian cities assisted Sparta against the Athenians and in 424 defeated them. The League became important again in the movement against Spartan hegemony but was beginning to break up because of the dislike of Theban supremacy encouraged by Sparta in an attempt to weaken her growing circle of enemies. The destruction of Thebes by Alexander the Great removed the principal city of the confederation and broke down the independence of the Boeotian confederacy which henceforward generally supported the Macedonian kings until its dissolution by Rome.

**Boers**, a Dutch name meaning husbandmen, used for the inhabitants of S. Africa who are of Dutch race and descendants of the Dutch colonists of S. Africa (see BOER WARS).

**Boer War** The first Boer War (1890-1) between the British and the Dutch in S. Africa was fought over the independence of the Transvaal. Originally a State founded by Boers emigrating from British S. Africa, the Transvaal was annexed in 1877 by Great Britain owing to native disturbances there. After winning a victory over the British at Majuba Hill in 1881 the Boers secured the independence of the Transvaal subject to British suzerainty.

The second Boer War in 1899-1902 was occasioned by the treatment of foreigners in the Transvaal republic. The discovery of gold on the Rand had brought about an influx of British subjects who had no political rights in the Transvaal but suffered under various grievances such as high taxes.

tion Neither petitions by these foreigners, nor remonstrances by the British Government availed in obtaining concessions from Kruger, the President of the Transvaal On the suggestion of Cecil Rhodes, a rebellion was organised (1895), but disagreement amongst its leaders delayed it The Boers were ready when Dr Jameson invaded the Transvaal and captured him with little difficulty British opinion, in many ways sympathetic with the Boers, was annoyed by the congratulatory telegram sent by the Kaiser to Kruger The situation grew worse, and the shooting of an Englishman by a Boer policeman (Dec 1898) drew forth a petition from the foreigners in the Transvaal to the British Government for intervention The British Government could get no satisfaction out of the Boers, and neither side would climb down In Oct 1899 an ultimatum from Kruger precipitated war

The war opened by the Boer invasion of British S Africa and the investment of Mafeking and later Ladysmith By 1900 the Boers had been successful in several actions with the British, notably at Colenso and Spion Kop A British victory at Paardeberg and the relief of Ladysmith in 1900 marked the turning-point in the war Mafeking and Kimberley were relieved, and in Oct the Transvaal and the Orange Free State were annexed by Lord Roberts, the British Commander-in-Chief The remainder of the war was occupied in wearing down the guerrilla tactics adopted by the Boers The Boers gave up the struggle in 1902, and peace was signed at Vereeniging The Boers became British subjects, but with certain privileges, such as the teaching of Dutch in the schools

**Boëthius, Amicius Manlius** (470 ?-524 ?), Roman philosopher, offended Theodoric, King of the Goths, and was imprisoned and executed He wrote, while in prison, *De Consolatione Philosophiæ*, a dialogue between himself and Philosophy, which was trans-

lated into English by Alfred the Great, and again by Chaucer

**Bog Bean** (*Buck-Bean*, or *Marsh Trefoil*), a low-growing perennial plant of the family *Gentianaceæ*, the only British member of that family which has divided leaves The large leaves overtop the stem, which bears a cluster of flowers, bright rose-coloured in the bud, and, when expanded, with a thick white fringe on the inner surface of the petals The plant flowers in June or July, and grows in bogs or stagnant water The extremely bitter root is a valuable tonic

**Bog Butter**, the name given to a substance that is sometimes found buried in peat bogs It is a fatty hydrocarbon, of animal origin, also known as *Butyrellite*, one explanation of its presence is that it is formed from butter buried formerly in the bogs as a security against famine The butter has naturally undergone a profound change during its centuries of burial, the lower fatty acids which are volatile and water-soluble have escaped, and a thick rancid fatty mass is left, bearing in some cases a faint resemblance to adipocere (*q v*)

**Boghaz Keui**, village near Angora, Anatolia, interesting on the score of the tablets with cuneiform writing discovered near by The site appears to have been that of the capital of the Hittite empire at one period See also *ASIA MINOR*

**Bogie**, a device for enabling vehicles running on rails to turn corners without injury being caused to the rails and wheel flanges by reason of their being excessively out of alignment Nearly all long railway carriages are now supported upon two four-wheeled bogie trucks, each of which has quite a short wheel base The bogie is free to turn about a vertical pin by which it is linked to the carriage, this vertical pivot is often allowed a little side play by being inserted in a sliding block surrounded by rubber

**Bognor Regis**, a popular English S. coast holiday resort It has been in

considerable reputo since the King's  
invalence there in 1979 after his  
ness of the previous winter This  
ent is commemorated by the addi  
on of Regis to the original name  
ogor Pop (1931) 13-10

**Bog Oak** (*Bog Wood*) trunks of oak  
ees that have been buried in peat  
ogs and thus preserved from decay  
he wood is occasionally used for the  
anufacture of furniture

**Bogomils**, a Christian sect which  
ppeared in the Balkans in the 11th  
ent. Their chief tenet was a  
ualist view of the creation They  
ected all symbols even the Cross  
nd denied the crucifixion of Jesus  
h y spread as far W as Bosnia in the  
4th cent Pope John XXII urged  
he King of Bosna to check them  
They appealed to the Turks for pro  
ection and finally most of them  
ecame Mohammedans

**Bogotá** (or *Santa Fé de Bogotá*)  
capital of Colombia c 900 m 1 N E  
of Buenaventura The town is magni  
ficently situated in an elevated agri  
cultural valley where large crops of  
fruit cereals and vegetables are pro  
duced Bogotá has several excellent  
schools and colleges and has long been  
a cultural centre in S America It  
was founded about the middle of the  
16th cent and rapidly became the  
capital of Nueva Granada and a centre  
of Spanish influence in the continent  
After Bolivar's victories and the  
creation of the Free State of Colombia  
Bogotá became the capital Pop  
(19 8) 355 500

**Bohemia**, part of Czechoslovakia  
since 1918 an independent kingdom  
from the 6th cent AD until abso bed  
into the Habsburg domains in 158  
It was ruled by the Premyslide Princes  
Perpetual fighting changed the actual  
boundaries continually Under Boles  
lav II (c 900) Bohemia included  
Moravia a part of Silesia and Galicia  
Premysl Ottokar II conquered parts of  
N Italy In 1306 Bohemia was claimed  
as a fit of the Holy Roman Empire  
and Rudolf son of the Emperor  
Albert elected king John of Luxem

burg following in 1308 The latter part  
of this dynasty was troubled by the  
Hussite movement (q t) When Sigis  
mund the last Luxemburg ruler died  
in 1437 civil war followed At the end  
of the 15th cent the crowns of Bohemia  
and Hungary were joined With the  
accession of the Habsburgs in 158 a  
period of decline began Religious  
liberty was gradually suppressed and  
Protestantism put down and by the  
end of the 17th cent its civilisation  
generally had reached a low ebb  
In the 19th cent however a national  
movement again arose See also  
CZECHOSLOVAKIA

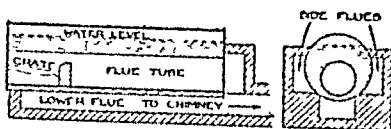
**Bohr Niels** (b 1885) famous Danish  
physicist He was awarded the Nobel  
Prize (Physics 1922) for investigations  
on the atom discovered a new element  
hafnium and with Prof Lord Ruther  
ford has elucidated the quantum  
theory

**Boil**, medical term for a small hard  
swelling of the skin which has a core  
of hard tissue and is typically sup  
purating It is due to infection by a  
microbe and occurs as an accompani  
ment of some diseases and in people  
whose blood is out of order The  
best treatment is to lance the boil  
squeezing out the contents if necessary  
and so clear it and then to purify the  
system to prevent the development of  
fresh boils

**Boileau Despréaux, Nicolas** (1636  
1711) French poet and literary critic  
published his first important work in  
1660 From then until 1666 he wrote  
many satires on literary subjects in  
which he laid down the principles of  
French verse His *L'Epître* appeared  
after 1669 distinguished by the polish  
and purity of their style His great  
works *L'Art Poétique* and *Le Lutrin*  
were published in 164 The former  
an imitation of the *Ars Poetica*  
(Horace) was imitated in its turn by  
Pope in his *Essay on Criticism* and in  
it Boileau appears as the great law  
giver of French literature His pre  
cepts on style and form were followed by  
French poets for centuries *Le Lutrin*  
was a mock heroic poem to which

Pope's *Rape of the Lock* is similar. Boileau held a place at Court, but his satires involved him in many disputes with men of letters and with the Jesuits.

**Boiler**, strictly speaking, any vessel to which heat is applied in order to convert a liquid into a vapour. A boiler may be either open or closed



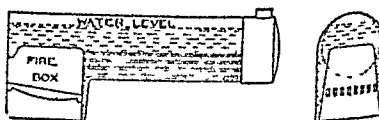
Cornish Boiler, set in Brickwork

In the former case the temperature of the steam formed from water remains at about  $212^{\circ}\text{F}$ , and its pressure is the same as the atmosphere, that is, about 14.7 lb per sq in. Such boilers are now regarded more as water heaters, and the term boiler is used more especially for a closed vessel in which water is converted into steam, the temperature of the steam generated depending upon the pressure which it exerts on the inside of the boiler. Two considerations mainly determine the form of a boiler: (1) its strength to resist the internal pressure of the steam, and (2) its ability to produce a maximum amount of steam from a given source of heat. The spherical form is strongest, and seems to have been the earliest used, but as it presents to the fire a minimum of heating surface in proportion to its size, it has a low efficiency as a steam raiser. Boilers for industrial purposes are divided into two classes, fire tube boilers and water tube boilers.

The commonest forms of fire tube boilers are the Cornish, Lancashire, Galloway, vertical, and locomotive. The Cornish boiler consists of a horizontal cylindrical shell from 4 to 8 ft in diameter which encloses a smaller cylinder called the flue, which contains the fire grate at its front end. The boiler shell is set in brickwork, so that the hot furnace gases after leaving the fire tube have to pass back along the bottom of the shell and forward under-

neath the shell to the chimney. Lancashire boilers are similar to Cornish, but they have two flue tubes placed side by side. Galloway boilers, which may be of Cornish or Lancashire type, have tapered water tubes placed diagonally across the flue tubes. Vertical boilers with a plain cylindrical outer shell are only made in smaller sizes, and are used chiefly for small heating installations, and portable engines, cranes, etc. The ordinary type of locomotive boiler has a square fire box at one end which is surrounded by water, and a smoke box at the other. There is a cylindrical drum which contains from 200 to 300 small straight tubes through which the hot furnace gases have to pass on their way to the chimney.

For generating steam on a large scale, fire tube boilers have been largely superseded by water tube boilers, as these possess several advantages. A large amount of heating surface can be obtained in a comparatively small space, and proper circulation of the water in the boiler can be arranged. Further, the parts, being all of small diameter, are of less thickness for a given pressure, and the whole weight is reduced. The risk of damage by explosion is considerably less, as a single tube may burst without affecting the remainder, and also each tube can easily be made of exceptional strength. Among the numerous varieties of water tube boilers two



Locomotive Boiler

outstanding types are the Babcock & Wilcox, and the Stirling.

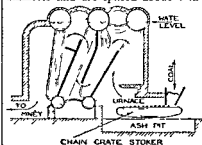
In its simplest form, the Babcock & Wilcox boiler consists of a horizontal boiler drum, underneath which is an inclined group of water tubes. These tubes are usually 3 in in diameter and are spaced with their centres from 6

to 9 in. apart. Their ends pass into headers of square section which connect them to the drum. By means of baffles placed across the tubes the hot gases from the furnace are made to intercept the bank of tubes several times before being finally passed to the chimney. As the water becomes heated it rises up the inclined tube drawing cooler water after it from the drum. Thus an almost perfect circulation is set up which is essential in a water tube boiler. Lack of circulation means that steam becomes trapped in a tube and this causes the tube to get burned with the result that it ultimately bursts. In all the larger sizes of Babcock & Wilcox boilers the drum is placed at right angles to the tubes thus giving a much greater width of furnace.

When steam is in contact with water in a boiler it contains particles of water in suspension and is known as wet or saturated steam. Dry steam is obtained by passing the steam through tubes situated in a hot part of the furnace. These tubes are termed the superheater the steam so treated being dry or superheated steam.

A considerable number of power station boilers are now equipped for

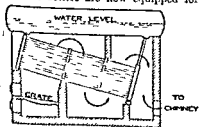
best-quality firebrick will not stand it and the furnace walls have to be water cooled. This is usually accomplished by making the furnace walls of a single row of vertical tubes which are covered with special iron or firebrick blocks. These tubes which are about 3 in. in diameter and are spaced about 6 in.



Stirling Boiler

apart are connected top and bottom to the boiler drum and since the water in them boils they represent an additional source of steam supply. Some idea of the intense heat generated by using pulverised coal can be obtained from the fact that several boilers are in operation in which the ash produced by the powdered coal is run out of the furnace in a molten state. In other boilers the ash is sprayed with water which causes it to granulate instead of collecting in a treacherous mass.

The Loeffler boiler is unique in that the boiler drum is away from the furnace and only the superheater is in the furnace. About one third of the steam from the superheater goes into service the remainder being passed into the water in the boiler drum. Owing to its high temperature this superheated steam boils the water in the drum thereby producing more steam which is pumped by a special pump into the superheater. One of the advantages of this type is that since the feed water never comes into contact with heated tube surfaces it is not necessary to take meticulous care over its composition to prevent tube corrosion.



Babcock & Wilcox Boiler

burning pulverised coal. With this system the coal is ground to powder and blown into the furnace through the burners. It is either by a special apparatus or by means of a flare of cotton waste soaked in oil and it burns like a gigantic torch. So intense is the heat generated that furnaces built of

In the Velox Explosion Type boiler the combustion takes place under pressure. An explosive mixture of fuel and air is supplied to the combustion chamber by means of a compressor. The mixture is ignited and the pressure rises to 4 or 5 times the charging pressure. A discharge valve opens and allows the high-pressure gases to pass through tubes surrounded by water. The water is boiled and the cooled gases, as they still have some pressure in them, are led away to a gas turbine, which works the compressor for charging the furnace.

Probably the most striking innovation of recent years is the use of mercury instead of water in a power-plant boiler. The boiler consists of a drum, from the bottom of which project a number of tubes having their ends sealed, and containing an inner tube which is surrounded by a sealed air jacket. The air jacket enables mercury to be delivered down the centre tube to the bottom of the outer tube free from vapour, evaporation taking place between the outer tube and the air jacket. The mercury level is only about one-quarter of the way up the drum, and a further economy in the amount of mercury used is effected by means of a large block of iron which nearly fills the boiler drum up to just above the mercury level. Further developments in this type of plant are likely, and the idea of generating vapour in the furnace walls will probably be applied. *See also COMBUSTION, POWER STATION, TURBINE, FURNACE.*

**Boiler Compounds** are substances added to the water used in steam boilers with the object of preventing the deposit of scale. Most of them can only be regarded as an imperfect and undesirable substitute for the proper softening of the water and consequent removal of the scale-forming lime and magnesium compounds. By adding soda ash, caustic soda, and sodium phosphate to water, the calcium and magnesium compounds are thrown down, and such substances may be used

wherever proper water-softening plant is not available. An excessive amount of alkali is not injurious in low-pressure boilers, except in so far as priming, i.e. the excessive formation of spray in the steam, may be caused by it, and by the presence of excess sludge. The use of tannic acid in various forms is very common, but unquestionably corrodes iron. It is generally employed in the form of catechu, and is to be found in the majority of advertised boiler compounds. Gummy or gelatinous organic matter prevents the formation of scale in many instances, and starch, dextrine, gum, molasses, and various vegetable matter, yielding gum tannin, are largely used for the purpose, but they may also form coating themselves.

Recently, a satisfactory system of precipitating scale-forming substances in the boiler has been devised. A mixture of soda ash or sodium phosphate with a specially stabilised sodium aluminate solution (Alfloc) is employed.

*See J. H. Paul, Boiler Chemistry and Feed Water Supplies (London 1919).*

**Boiling-point.** The boiling-point of a liquid is defined as the temperature at which the vapour pressure of the liquid is equal to the external atmospheric pressure. This latter is taken to be standard at 760 mm of mercury, and this is the pressure at which all boiling points are measured. The boiling-point of a liquid is an important physical characteristic, and the fact that different liquids boil at different temperatures is the basis of the method by which they are separated (**DISTILLATION**).

On ascending to high altitudes, the change in boiling-point becomes important, and instruments have been devised called *hygrometers*, in which the altitude is measured by determining the boiling-point of water and reading off the height from a specially constructed table. At atmospheric pressure further heating of a liquid

at the boiling point will not raise its temperature but merely increases the rate of evaporation. The boiling point is raised by the addition of matter that dissolves in the liquid. If a liquid is subjected to a pressure greater than atmospheric the boiling point rises and *vice versa*.

**Bois de Boulogne** great park of Paris probably acquiring its name from the town Boulogne-sur-Seine which is quite near. In area it covers c. 100 acres. Napoleon III presented it to the city of Paris and the Avenue du Bois de Boulogne was opened in 1855 under the name Avenue de l'Impératrice.

The Bois as it is popularly termed is well equipped with restaurants and race-meetings are held at Longchamp and Auteuil.

**Bosé** [boi zā] principal city and State capital of Idaho, U.S.A. in a valley of the Rockies. It is a municipal air port and a banking and commercial centre for the surrounding mining and agricultural districts. Fruit is grown on a large scale in the vicinity. Pop. (19-7) 25 00.

**Bokhara** (*Bukhara*) city and administrative district of the Uzbek Republic (U.S.S.R.) in Central Asia. The old district of Bokhara has been partitioned under the Soviet régime and part of it is included in the Republic of Turkmenistan. The city is situated on the Transcaspian railway at the convergence of many caravan routes. It is the greatest mart in Central Asia with a large trade in textiles (carpets etc.).

Bokhara was an important centre of Mohammedan culture and many of the ancient mosques are strikingly beautiful. The great bazaar extending for 7 m. is a remarkable feature. Pop. of the district c. 1 000 000 of the city (1928) 74 000.

**Boldrewood**, Rolf, pseudonym of Thomas Alexander Browne (1896-1918) Australian novelist. He wrote several popular works concerning life in the gold fields and ranches including *Robbery under Arms* (1888) based on

the exploits of the notorious Kelly gang.

**Boleslaw I** King of Poland from 990-1035 raised Poland to a great power by seizing Pomerania invading Germany to the Elbe and attacking Bohemia besides exercising overlordship in Russia.

**Boletus** a group of large fungi commonly called puffball. Many species are edible. When ripe the fruiting body bursts and scatters large numbers of spores into the air. Each fruiting body produces many thousand spores.

**Bolingbroke** Henry St. John Viscount (1678-1751) English statesman, Tory M.P. from 1701. Secretary for War under Harley in 1700 and Secretary of State in Harley's next ministry 1710. Bolingbroke was British representative at the signing of the Treaty of Utrecht (1713) but in 1714 a widening breach between Bolingbroke and Harley brought the former the leadership of the Tory Party. He favoured a Jacobite restoration but Anne's sudden death stopped this plan and Bolingbroke was dismissed by George I. He was pardoned in 1723 but Walpole's victory at the 1735 elections signalled the end of his political career.

**Bolivar** (1) State in Venezuela, with British Guiana on the East. Capital Ciudad Bolivar area 91 891 sq. m. The country consists of large plains, forests and many rivers. Gold from the El Callao mines is one of the chief exports. Others include tobacco and rubber. Pop. (19-6) 99 033 (?) Capital of the state on the R. Orinoco and a trading centre and river port (pop. 16 000). Exports include live stock, timber, tobacco and hides. The town was founded in the 18th cent. and renamed after Simon Bolivar who made it his headquarters in the struggle against Spain. (2) Department of Colombia, S. America. Area 23 515 sq. m. Country chiefly consists of heavily wooded plains, partly cultivated. Capital Cartagena, on Caribbean coast. Railway extends



from Cartagena to Calamar, a distance of 65 m Pop (1928) (White and Negro) 643,000

**Bolivar, Simon** (1783-1830), revolutionary leader in the Spanish-American colonies, and an outstanding figure in the history of the New World, born in Venezuela. He initiated revolutions in Venezuela and New Granada, and united the Republicans of these areas with Colombia, thus ending Spanish domination in S America. He helped Peru to gain independence in 1825, and as a result the upper part of Peru was renamed Bolivar (subsequently Bolivia) in his honour. His dictatorial rule as president of Colombia became, however, unpopular. Venezuela separated from Colombia in 1829 and Bolivar resigned in 1830.

**Bolivia**, republic of S America, area, 514,100 sq m. The republic is divided into 8 departments, 3 territories, 72 provinces, and 681 cantons. It is bounded on the N and E by Brazil, S by Argentina, and W by Chile and Peru.

Bolivia is one of the chief tin-producing countries of the world, with

copper-mining as next in importance. Other minerals found are gold, silver, lead, and zinc. Tobacco, rice, vegetables, and fruits are also produced in fair quantities, but metals comprise the largest item for export. The first railway was opened in 1892. The total length of railways is c 1400 m. The most important form of communication, however, is carried on by light-draught vessels on the thousands of miles of waterways. The Bolivian Andes assume the form of two parallel chains between which lies a plateau 12,000 ft high. Large areas of the country consist of low alluvial plains and swamps, but there are extensive districts which are rich agriculturally. Chief rivers Beni and Mamoré. There are several lakes, of which Titicaca, one of the highest lakes in the world (12,507 ft), covering an area of 3200 sq m, and Poopó, covering an area of 1000 sq m, are the most important. The llama, tapir, wild cat, jaguar, puma, and alpaca are to be found on the densely forested slopes, whilst in the tropical valleys and slopes are the American ostrich and a species of large stork.

The constitution of the republic dates from 1880. The President and two Vice-Presidents are elected by popular vote for a term of 4 years. They are not, however, eligible for re-election. Congress sits at La Paz.

The early history of the country is stormy. In the 16th cent., after the Spanish defeat of the Incas, the territory was known as Alto Peru. Attempts to oust the victors continued right up to the first quarter of the 19th cent. In 1825 the name Bolivia was chosen for the country. In 1826 General Sucre was elected the first President. Relations with Chile were strained during the 19th cent., and eventually Bolivia fought a successful war with that country (1879-83). Negotiations to settle with Paraguay the boundary dispute in the Gran Chaco were opened in 1927. These failed and both sides engaged in hostilities after which the matter was referred to



Bolivia Chorate Aschklusong Indian

the League of Nations which at the end of 1932 agreed to send a commission to investigate the dispute Pop (1931) 3 014 000

**Bollandists** the collaborators in the compilation of the lives of the Saints *Acta Sanctorum* begun by Jean Bolland 1596-1665 and continued by the Belgian Jesuits

**Boll Weevil**, see COTTON BOLL WEEVIL

**Boll Worm** see COTTON BOLL WORM

**Bologna** [BOLO NYA] Italian city capital of the Province of Bologna in Emilia c 50 m from the E coast. The many fine public buildings include San Sepolcro Church (6th cent) the 10th-cent cathedral the ancient 4th-cent cathedral and the picture gallery. The university dates from the 11th cent and has numbered Dante Petrarch and Tasso among its students. There are interesting remains of the Roman town and the Museo Civico contains many valuable local antiques. The modern town has flourishing manufactures of sausages sugar liqueurs and railway stock. It is an important railway centre. It fell to the Hungarians in the 10th cent and became a papal possession in the early 10th until the unification of Italy in 1860 Pop (1931) 246 980

**Bologna, Giovanni da** (1344-1608) Italianised name of Jean Bologne (or Boullongne) a Flemish sculptor. Bologna was born at Douai but spent most of his life in Florence where he went when 29. He also visited Genoa and Bologna in the latter city is a beautiful fountain he designed. His best known statues are the equestrian bronze of *Cosimo Medici* at Florence a marble *Fape of the Sabines* and his bronze *Mercury*.

**Bolometer** an extremely sensitive instrument for measuring a small rise in temperature. It consists of a blackened platinum wire which forms one arm of a Wheatstone bridge (see ELECTRICITY) when this is heated its resistance rises and this sets the balance of the circuit which causes a deflection in the galvanometer connected in it.

A good instrument will indicate a temperature rise of one hundred millionth of a degree. See also RADIO METER TEMPERATURE MEASUREMENT OF

**Bolshevism** (from *bolshoi*—large or great) originated at the 1904 Congress of the Russian Social Democratic Party when a programme was put forward by the Left Wing stating its belief that Socialism (*q.v.*) could not be built up through constitutional channels but that forcible seizure of power by the workers would be necessary before a Socialist State could be established. The larger part of the programme was accepted by the Left Minority and the majority (henceforward called Mensheviks—minority) reaffirmed their belief in the possibility of gaining power through parliamentary action whence their name as they only accepted a minority of the programme laid down.

The Russian Bolsheviks formed the nucleus of the Russian Communist Party which took over power in Oct 1917 after the short lived Menshevik régime which succeeded the March revolution of that year. See COMMUNISM

**Bolton** large industrial town of Lancs c 12 m N.W. of Manchester chiefly noted for its large manufacture of cotton goods which were important even before modern methods were evolved by Arkwright and Crompton both natives of the town. In the Middle Ages and until the 18th cent it was a famous woollen centre. The town is of ancient foundation though the growth to its present size and wealth is modern. Secondary but still important industries are bleaching and iron founding. Pop (1931) 177 53

**Bolton Abbey** village in Upper Wharfedale W. Riding of Yorkshire. Near by are the ruins of Bolton Priory an Augustinian house founded c 1100 and moved to its present situation in 1151. The Priory became of great wealth and consequence, falling at the dissolution (1540) to the

**Clifford family** It is now the property of the Dukes of Devonshire The greater part is in ruins, but the nave, a handsome Early English structure, still stands, and there are fragments of Transitional Norman work

**Bolzano**, capital of the province of Bolzano, Italy, a busy commercial town situated at the confluence of the Talfer and Eisach Its Gothic church has two lions of red marble which guard its W portal, and the altar-piece by Lazzarini, a pupil of Titian In the museum, with its large library, there is a fine collection of Tyrolese costumes Pop (1931) 40,759

**Boma**, port on the Congo, in the Belgian Congo Territory, until 1927 the capital of the State It is still a considerable export centre for native products (*see* BELGIAN CONGO) It was founded as a slaving station and *entrepôt* by merchants of several European countries in the 16th cent Pop c 3000 (c 500 Europeans)

**Bomb**, originally an artillery shell The term is usually applied to explosive or incendiary shells dropped by aircraft, and, though less correctly, generally to grenades (*qv*)

**Bombardier**, originally an artillery soldier in charge of a cannon, now designates the lowest grade of non-commissioned officer in the artillery, whose rank is equivalent to that of corporal

**Bombardier Beetle**, a small ground beetle which, when attacked, defends itself by ejecting with a sharp explosion a volatile fluid with a pungent odour

**Bombardment**, a concentrated attack by artillery fire, originally directed against walls and houses only, with the object of intimidating the inhabitants or defenders Many regulations were drawn up at The Hague Conference of 1907 with the object of protecting civilians and historic or artistic buildings from bombardment, but these were generally ignored in the World War, in which Verdun, Paris, and Ypres were among the towns bombarded Bombardment was chiefly

used from 1914-18 as a means of dislodging entrenched troops, and in some cases was maintained for several successive days

**Bombardon**, the lowest instrument in the Saxhorn family—the low bass Saxhorn or tuba

**Bombay**: (1) Presidency, large territory in W India, extending along the greater part of the W coast The coastline has two large indentations in the Gulfs of Cutch and Cambay, and a number of small ones, providing good harbours at Bombay and elsewhere.

The surface is uniformly low except for the ranges of the W Ghats Much of Sind, in the N, is taken up by the



Bombay High Courts and Clock Tower

lower valley of the Indus Other rivers are the Nerbudda, and the Tapti

The climate shows considerable variations, from extreme dry heat in the N, to normal conditions on the Deccan, the Tableland of the W Ghats There is very heavy monsoon rainfall in many districts of the S There are rich forests in the hills, and in several of the river valleys, especially the Indus

About two-thirds of the population are engaged in agriculture, the main crops being wheat, millet, and rice. Cotton forms the staple manufacture Local factories are encouraged, and in 1931 there were c 136,000 looms. Smaller industries are silk, paper, metal-work, and leather goods. Both stone and salt are marketed

The Governor is the head of the Administration which consists of an executive council of 5 members and a legislative council of 114-86 of whom are elected. Local government is carried on by Commissioners of the numerous divisions and municipalities.

W. India has been known since many centuries B.C. and was held by the Persians, White Huns and Arabs. The earliest English settlement in modern Bombay was at Surat in 1618 where the E. India Company established a factory. Two cents later when the Government had taken over the district, it was rapidly extended to its present dimensions. The chief towns are Bombay, the capital, Surat, Karachi, Poona and Ahmedabad.

Area (British districts) 123 000 sq m (Native districts) 98 500 sq m  
pop. (British districts) 21 000 000 (Native districts) 4 000 000 (1931)

(<sup>o</sup>) Capital of Bombay Presidency, British India. It is situated at the S. extremity of Bombay island on a magnificent natural harbour with modern spacious docks and quays. A huge trade is handled in cereals, cotton and imported machinery. Bombay is an important railway centre and serves Delhi, Madras, Calcutta and other great cities. The principal local industry is cotton and many native and European factories are established. Tanning and working in precious metals are also extensive. The university, modelled on London University, is one of the foremost educational institutions of India, having many affiliated schools and colleges all over the Presidency. Other public buildings of note are the Government and municipal buildings, the Victoria Station and the Royal Scientific Institute. The native bazaar, unusually commodious and well built, does enormous business in common with other commercial parts of the city.

The island became a Portuguese but was ceded to the British in the mid 18th cent as part of the dowry of Catherine of Braganza.

brought to Charles II. For many years it was merely a trading centre of the E. India Company, but under Government administration the city grew rapidly in size and importance. Sanitation helped to prevent the periodic epidemics of plague. With the coming of the railways Bombay rapidly grew to be second city of India, a position which large-scale town planning and the modernisation and fortification of the harbour have maintained for many years. Pop. (1931) 1 161 400.

**Bombay Duck**, commercial name for the hummalow, a small phosphorescent fish akin to the pike which inhabits the Indian Ocean and is captured in large quantities off the coasts of Bombay and Malabar. The fish are salted and dried and form a much valued article of diet in India and elsewhere.

**Bona** (BONA) Algerian port c. 600 m W. of Tunis with a large export trade in iron, zinc, phosphates, agricultural products and cork. Imports consist of general manufactured goods. The harbour can accommodate fairly large vessels. The cathedral, Grand Mosque and citadel are of interest. Bona stands near the site of the ancient Hippo Regius, celebrated for the long residence there of St. Augustine. It was a flourishing Roman city, later sacked by the Vandals. St. Augustine's library and manuscripts were fortunately preserved. Pop. (1931) 64 800.

**Bona Fides** (Lat. good faith), term implying the absence of all fraud or unfair dealing, whether by act or omission.

**Bonaparte**, name of an Italian family (originally spelt Buonaparte), a member of which left Italy for Corsica in the 16th cent., founding the family from which NAPOLEON I (qv) of France was descended.

**CHARLES BONAPARTE** (1746-1835), father of Napoleon, held offices in Corsica under the French Crown and had his sons educated there. He had 8

*Joseph*, three daughters, and *Lucien*, *Louis*, and *Jerome*

**LUCIEN** (1775-1840), was deputy for Corsica 1798, President of the Council of Five Hundred, 1799. After a breach with Napoleon over his marriage, he lived in Italy for some years, returned to support Napoleon in 1815, and again retired to Italy.

**LOUIS** (1778-1846), was aide-de-camp to Napoleon in Egypt (1808-9); Governor of Paris 1805, proclaimed King of Holland after the battle of Austerlitz, but Napoleon accused him of allowing his subjects to trade secretly with England, and finally attacked and annexed Holland in 1810, whereupon Louis fled to Bohemia. He was father of Napoleon III.

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**Bonaventura, St** (1221-1274), Franciscan friar, he entered the Order in 1243, and was made general in 1255. He was a theologian of renown, standing apart from the schoolmen as emphasising emotion rather than intellect. He is known as the "Seraphic Doctor."

**Bond**, a written acknowledgment under seal of a debt. Goods stored in a *bonded warehouse*, i.e. a warehouse licensed by the commissioners of Customs and Excise for the storing of dutiable goods without payment of the

duty until they are taken away, are said to be *in bond*, because it is necessary to enter into a bond securing the Crown against loss of duty by removal of the goods without payment.

**Bondfield, Margaret Grace** (b. 1873), British Labour politician, secretary to National Federation of Women Workers, 1921, chairman Trades Union Congress, 1923, MP for Northampton, 1923, Parliamentary Secretary to Ministry of Labour, but



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**Bonding of Rails**, see ELECTRIC TRACTION.

**Bonds**, see STOCKS AND SHARES.

**Bone** (anat.) In man, bone performs the dual function of protecting the delicate nervous system, and of supporting the body in an erect position.

**Structure of Bone**. In general we may describe a bone as consisting

of a hollow tube with two solid ends. The tube and the ends are made up of calcium and magnesium salts which are laid down upon a meshwork of fibrous tissue as a hard solid mass. This mass is riddled with small holes containing blood vessels. In the cavity of the tube is a substance known as bone marrow and this as is explained in the article on BLOOD is one of the chief factories of blood formation.

**Periosteum.** The surface of the bone is covered by a thin membrane known as the periosteum—the only part of the bone which contains nerve fibres. Therefore when a bone is broken or fractured we do not feel pain in the actual bone but a sensation of pain is produced by the torn or stretched periosteum. A good example of this phenomenon is the pain felt when we knock the surface of our shin bone.

**Cartilage.** At the end of the bone there is no periosteum but instead the bone is covered by a smooth glistening substance known as cartilage. This forms part of the joint (*q.v.*)

**Durability.** Contrary to what is generally imagined bone is one of the least durable substances in the body. There are two types of special cell always at work in bones: one dissolves bone and the other renews it. The former is known as an osteoclast cell, the latter as an osteoblast. Thus it is that bones can so easily change their shape and it is also the reason why broken bones so soon mend. This fact also has some bearing on the physiology of bone.

**Physiology.** Under this heading we have to consider how it is that bones obtain their consistency and shape.

Let us begin with a common example. A man who rides a horse may come in the course of time to have bow legs. Briefly this can be explained as follows: for many years he has been having an unnatural pressure exerted upon the inside of his shin bones. Now when bone is subjected to continuous pressure over long periods of time the osteoclasts are stimulated into activity and dissolve that part of the bone

being pressed upon. To compensate for this the osteoblasts on the other side of the bone are stimulated to lay down more bone. The result: a bent structure. Another deformity of bone which is produced in quite a different manner is a disease called rickets. Here we have the same results as in the case of the man who rides a horse but the cause is deficiency in diet. This deficiency may be of milk which is very rich in calcium salts or of Vitamin D which appears to fill some important gap. Possibly it controls the absorption of calcium from the alimentary canal. It may on the other hand play a part in the formation of bone by the production of substances at the site of bone formation which stimulate the osteoblasts to convert soluble calcium in the blood into an insoluble form thus laying it down in a natural and normal manner.

**Circulation.** Blood absorbs from food in the alimentary canal salts of calcium and magnesium and carries them to all parts of the body. Normally such salts are deposited only at the sites of bone formation. It has been found by experiment that at these sites are substances which promote the conversion of the calcium and magnesium salts from a soluble to an insoluble substance with the result that they are deposited from the blood at these sites and new bone matter is formed. The exact mechanism of this process is not yet wholly understood but among other things probably an important feature is the stimulation of the osteoblasts. However this may be we do know that in growing bones the osteoblasts are very active.

**Bone Murhead (b. 1876)** Scottish artist famous for his drawings and etchings of architectural subjects. Bone was born at Glasgow and trained in the School of Art there. He came to London in 1901 after issuing a portfolio of his Glasgow etchings. He excels in dry points and drawings of intricate scaffolding. He was an official artist during the World War and did much work at the front and with the Navy.

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**Bone Ash**, obtained by burning untreated bones, used in the manufacture of fertilisers. It is also used in the manufacture of baking powders, assay cupels, and in the porcelain industry. It is imported chiefly from S America.

**Bone Black**, *see* CARBON, TECHNICAL FORMS OF

**Bone Fat**, *see* BONE PRODUCTS

**Bone Fertilisers** consist chiefly of calcium phosphates either in the original condition or treated to give superphosphate. *See also* BONE PRODUCTS

**Bone Implements**, *see* STONE AGE

**Bone Oil**, or Dippel's oil, the oil obtained by the destructive distillation of bones. Sometimes also applied to the fatty oil obtained from bones. *See also* BONE PRODUCTS, and CARBON, TECHNICAL FORMS OF

**Bone Products** When bones arrive from the slaughterhouse they are first degreased. There are three ways in which this operation may be performed, by boiling the bones with water, by autoclaving the bones with steam under pressure, and by extracting the fat with petroleum solvents. The first two methods, whilst giving a good quality fat that can be used for the manufacture of soap and as a base for ointments, have the disadvantage that the yield of fat is only, at the best, two-thirds of the total content, and that a large proportion of the water-soluble gelatinous constituents of the bones are lost. The solvent extraction method gives the highest yield of fat, but since this latter is of very poor quality, it can be used only for the manufacture of the very roughest grade of soap and as a source of fatty acids for making candles. Nevertheless, chiefly owing to the importance and value of the gelatinous constituents, the solvent extraction method of degreasing bones is being universally adopted.

The feet of cattle yield a special quality of oil, known as *neal's-foot oil*, which is used in leather dressing and, after filtration from any precipitated

stearin, as a lubricating oil for delicate machinery owing to its very low "cold test," i.e. the low temperatures at which the oil retains its fluidity.

The bones that are best suited for the manufacture of *glue* are those that have been degreased with solvents. The bones are then freed from dirt by mechanical brushing, and are autoclaved under pressure with hot water in order to extract the glue. The liquor is then clarified with alum and concentrated to the requisite degree. The concentrated liquor is treated with gaseous sulphur dioxide in order to bleach it, and is finally run into special cooling troughs, where the solution solidifies and the solid glue can be cut up into conveniently sized portions. The concentration of the glue liquor is almost invariably carried out under vacuum, so as to keep the temperature as low as possible. If open pans are used the resulting product is, despite bleaching, dark-coloured. *See also* ADHESIVES

An important part of the bone industry is the manufacture of *animal charcoal*. This is accomplished by the heating of degreased bones (which are sometimes also partly degelatinised) out of contact with air in special retorts.

*See also* GELATINE, IVORY BLACK

**Bonheur, Rosa** (1822-1899), famous French painter of animals, born at Bordeaux. She received her first instruction from her father, and from the age of 20 regularly exhibited at the Salon, but her first notable recognition came with the Paris exhibition of her works in 1855, when the sureness of her draughtsmanship and the realism of her animal studies attracted much attention. She is also notable for the fact that she was the first woman to receive, in 1894, the Legion of Honour.

**Boni**, *see* CELLBES

**Boniface, St.** (680-754), originally named Winfrith, reformer and missionary, born and educated in England. Going to Frisia with a mission, he made successful crusades against the

heathens was made archbishop (73) reorganised the Frankish Churches with missionaries from England and divided Germany into bishoprics. Became Archbishop of Mainz 744 but was assassinated by heathens at Fulda Feast day June 5

**Boniface** name of 9 Popes. **BONIFACE V** Pope 619-25 endeavoured to convert the English to Christianity. He made Canterbury the metropolitan see of Britain. **BONIFACE VIII** Pope 1268-1294 in attempting to increase the papal power quarrelled with most of the kings of Christendom especially with Philip IV of France over papal taxation of the French clergy. The French Vice-Chancellor was sent to arrest Boniface so that he could be deposed by an Ecumenical Council. He was arrested but released by the mob of Anagni. He died in 1303 imprisoned in the Vatican. The line of Avignon popes began after his death and the defeat of the papal forces by Philip IV.

**Bonington, Richard Parkes** (1801-1868) English painter born in Nottinghamshire and moved with his parents to Paris at the age of 15 where he studied painting. His works remarkable for their clear fresh colouring and feeling for space and atmosphere were greatly admired by the early French impressionists. Two of his works are in the National Gallery 5 at the Tate and a fine collection of his oils and water colours at the Wallace Collection in Hertford House.

**Bonin Islands** (*Ogasawara Islands*) Japanese group in the Pacific due E. of S. Japan. It consists of c. 30 volcanic islets some 30 sq. m. in area. Vegetation is luxuriant and valuable timber is exported. Numbers of turtles are caught and there is an abundance of tropical fruits. The capital is Port Lloyd the export centre of the islands. Pop. c. 5000.

**Bonito** a fish related to the Albicore (gr).

**Bonivard, François** (c. 1493-1550) prior of a Cistercian priory 1510 he opposed the attempts made by the Duke of Savoy to obtain possession of

Geneva. He was imprisoned at Chillon on Lake Lemman and was the hero of Byron's poem *The Prisoner of Chillon*. He became a Protestant after his release.

**Bonn**, Prussian town on the Rhine 15 m. S. of Cologne famous as the seat of a University and the birthplace of Beethoven. Pop. 90,749.

**Bonner Edmund** (c. 1500-1567) was ordained in 1525 became Wolsey's chaplain in 1529 and Bishop of London in 1539. Under Henry VIII he supported the royal against the papal supremacy in religious matters but he opposed the Protestant activity of Edward VI and his Council and was imprisoned by order of the Star Chamber in 1550 but on the accession of Queen Mary was restored to his See. During her reign he was active in the prosecution of Protestant heretics. On the accession of Queen Elizabeth he refused to take the oath of supremacy and was imprisoned in 1557 in the Marshalsea where he died.

**Bonnet** (1) A type of headgear fitting closely to the head with or without a brim. Bonnets made of cloth silk or velvet and later of felt were worn in England for many centuries by men of all classes. Gradually they ceased to be worn by any except labourers and artisans and during the 18th cent. the term became applicable only to those worn by women. To-day even these have become rare except for children and old ladies.

In Scotland bonnets in the form of tam-o'-shanters were worn by men to a much later date and the small pointed be-ribboned Glengarry bonnet is still worn by Scottish regiments to-day.

The Phrygian bonnet became the Roman emblem of liberty and as such it was adopted coloured red during the French Revolution and is now the traditional headwear of representatives of *La République*. (2) The term bonnet is also applied to an extra piece of sail which is laced to the bottom and it has also other technical and slang connotations.

**Bookbinding** includes the various

processes by which a complete book is formed from its component parts. Its history begins with the use of parchment sheets in place of papyrus rolls for the formation of books, for the sheets had to be fastened together at the back to make them into a book. The sheets thus fastened were then enclosed between stiff boards or some other durable material such as leather, and these outer covers were made the medium of various forms of decoration. The decorative work of the early bookbinders of England, Venice, France, and Germany is of great artistic value, and specimens by famous craftsmen are now collected by connoisseurs of the beautifully-tooled designs on leather mellowed in colour and polished by the loving hands of generations of owners. The first bindings were made for manuscripts, and with the coming of the printing press the craft flourished. Then the introduction of machinery, and with it cheaper printing, made the old handicraft too costly. The use of cheaper materials (cloth, paper, etc.) for binding and the invention of elaborate machines naturally followed, until to-day most books are put into binding-cases by a series of high-speed mechanical operations.

The operations, subsequent to the actual printing, which go to the making of a modern book are as follows:

(i) *Folding* Sheets of paper are so printed that, after they have been folded in a particular manner, the matter shall read consecutively. The size of a book, therefore, has strictly no reference to absolute size, but to the number of times the sheets of paper of which it is composed have been folded. A *folio* is a sheet folded once, forming 2 leaves; similarly, a *quarto* is folded twice, an *octavo* 4 times, a *duodecimo* 6 times, and a *sextodecimo* 8 times. The "signature" is a mark printed at the foot of each sheet to enumerate and distinguish it. In the case of early printed books, the size may be determined by examining the "wire-marks," or parallel lines which show up lighter than the rest of a page

when this is held up to the light. The wire-marks run horizontally for folio and octavo, and perpendicularly for quarto and sextodecimo, and either horizontally or perpendicularly for duodecimo (12mo) according to whether the book is tall or dumpy in shape. An octavo volume, therefore, made from large sheets may be very little different in actual size, or dimensions, from a quarto volume made from small sheets.

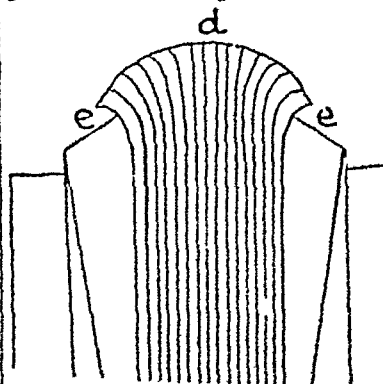
(ii) *Gathering and Sewing and Stitching* are the processes of collecting together into their right order, and stitching together, the folded sheets.

The stitched-together sheets are then (iii) *trimmed*, that is, the edges are cut so as to form an even surface when the book is closed.

A thin coating of glue is then applied to the back to help in holding the sheets together, and to give more firmness to the whole. This process is called (iv) *glueing up*.

The process of giving a book a rounded back, when this is required, is called (v) *rounding*.

(vi) *Backing* consists of making grooves to act as hinges for the boards.



Backer. (e) and (e) are grooves to take the boards; (d) is the spine.

to turn upon, so that these shall lie flat when the book is closed.

(vi) The outer case, or "binding."



## (1) JOURNAL

		Dr.			Cr.		
1933		£	s	d	£	s	d
July 1	Rent Account To J. Sinkins	28			50	0	0
	Being one quarter's rent for the office						

## (2) SALES BOOK (analysed)

Date	Purchaser	Particulars	To	Motor cars	Motor-bicycles	Service	Total
1933				£ s d	£ s d	£ s d	£ s d
July 1	M. Johnson	18 h p saloon	12	500 0 0			500 0 0
July 4	Col Smythe	14 h p side car	13		48 0 0		18 0 0
July 7	L. F. Ball	Overhaul	7			25 0 0	25 0 0
				500 0 0	18 0 0	25 0 0	573 0 0

## (3) TRADING ACCOUNT FOR THE YEAR ENDING DEC 31, 1932

Dr.		Cr.	
To stock Jan 1, 1932	£ 1137 0 6	By sales	£ 11163 9 6
" purchases	9873 12 0	" stock, Dec 31, 1932	1118 9 4
" gross profit, transferred to profit and loss account	1300 6 4		
	£12,310 18 10		£12,310 18 10

## (4) PROFIT AND LOSS ACCOUNT FOR THE YEAR ENDING DEC 31, 1932

Dr.		Cr.	
To salaries and wages	£ 364 4 6	By Gross profit as per trading a/c.	£ 1300 6 4
" rent, rates and taxes	267 2 1	" discount received	97 11 2
" general expenses	185 2 1		
" discount allowed	42 10 7		
" bad debts	67 6 2		
" depreciation	65 0 0		
" Net profit, transferred to capital account	436 12 1		
	£1397 17 6		£1397 17 6

## BALANCE SHEET AS AT DEC 31, 1932

Liabilities		Assets	
John Smith capital %	£ 3647 11 0	Furniture and fixtures	£ 660 4 4
Sundry creditors	832 4 6	Stock on hand	1148 9 4
		Sundry debtors	1347 8 0
		Cash at bank	1836 7 6
		Cash in hand	97 5 10
	£4479 16 6		£4479 16 6

take but equality does not necessarily prove correctness since a transaction may have been omitted from both sides or a fictitious one inserted

The *Nominal Accounts* or those which show changes in the amount of capital invested i.e. profits and losses are taken from the Trial Balance and made into the self-explanatory *Trading Account* and *Profit and Loss* [3] [4]

The remaining balances are summarised into the *Balance Sheet* of which the function is to show the financial status of the business and its relation to the proprietor and others [5]

A great many innovations have recently been introduced to increase the speed and efficiency of working. The *Ship System* modifies the invoice or receipt relating to the original transaction so that carbon copies may be filed direct in card or loose leaf ledgers without posting. In large banks mechanical book keeping upon loose-leaf sheets is now a common method of keeping customer's accounts.

Booklice are minute insects sometimes wingless allied to the parasitic like but found amongst old books where they feed on the paste used for binding

Bookplate a label usually pasted inside the front cover of a book bearing a name device coat-of-arms crest badge or any design signifying its ownership. Their use in England dates from Elizabethan times. They are also known as *Ex Libris*—i.e. from the books (of)

Book production. Neither the baked clay tablets of the Babylonians with their cuneiform character record ing history laws and the division of land in their empire nor the papyrus rolls of the Egyptians with their hieroglyphic symbol running lengthwise in sets of parallel columns at all resembled our modern books. Even the Greeks and Romans used the *volumen* or roll form 9 or 10 of the roll's being kept in a jar or box. The *codex* form of sheets folded to pages was used first for laws as being easier to consult and with the employment

first of parchment or vellum in W. Europe (from the 10th cent. A.D.) and later of paper was adopted both for manuscripts and for printed books (For block books see *WOODCUT*)

Printed books at first had no title page but the *Incipit* (here beginneth) introduced the subject and author and the *colophon* or closing paragraph supplied the name of the printer place of publication and date. Even these were not always given and besides the decorative printers' devices e.g. the windmill of Andrew Myllar Scotland's first printer and the dolphin and anchor of Aldus Manutius fictitious or imaginary place names and dates disguised in chronograms were frequent

Another feature which has now disappeared was the *registrum* or list of signatures to the quires or sections of the book placed at the end for the binder's use. Pages were not always numbered but frequently there was a catchword at the foot of one page which indicated the sequence

The early printers were also publishers and often scholars as well. The Aldi of Venice in the 15th and 16th cents and the Elzevirs of Leyden from 1580 were famous for their pocket classics and Caxton printed his translation of the *Recueil des Histoires de Tristram* (1474) before Chaucer's *Canterbury Tales* (1478)

In England a Royal Charter of 1557 gave the Company of Stationers of London a monopoly of printing on condition that they kept a record of apprenticeships and admissions of members and a register of copies. The restriction to London expired in 1693 but until the passing of the Copyright Act of 1811 every publication had to be entered at Stationers' Hall. Among 17th-century books Dryden's works were published by Jacob Tonson (1656-1736) Pope's by Lintott (1655-1736) neither of whom did the town printing and the 18th cent. saw the rise of regular publishing firms. Poulis of Glasgow and Longmans in London, among others. Later the

Roxburghe Club (1812), Early English Text Society (1864), New Shakespeare Society (1871), etc., were formed for the issue of special types of books

An "edition" of a book consists of all those copies which are printed from a single setting up of the text, but there may be several "impressions" of an edition taken at different times, and page-for-page "reprints" can be made from stereotypes taken before the type is redistributed

For illustrations of books, *see* ENGRAVING, LITHOGRAPHY, PHOTO-ENGRAVING, WOODCUTS *See also* BOOK-BINDING, PRINTING, TYPOGRAPHY

**Book-scorpion**, the type of a special order of the Arachnida (*q v*), known as the false scorpions, resembling the true scorpions in their jaws, legs, and great pincer-like claws, but differing in many ways, particularly in having no tail. The group is found in all temperate and warm countries, and the species, none of which exceeds about  $\frac{1}{4}$  in in length, are mostly found under stones or logs, sometimes amongst seaweed on the coast, or in houses, under the wings of large beetles, or clinging to the legs of flies. They feed upon mites, and make cocoons for moulting or for their eggs with silk spun from their jaws

**Boom**, *see* TRADE CYCLE

**Boomerang**, a wooden missile used by Australian aborigines. There are two types: (a) the non-return boomerang, which is used for war and hunting; (b) the return boomerang, used for killing birds, etc., which, after describing a circle in the air, flies back to the thrower. Both types are sickle-shaped, a twist of the arms determining the trajectory. Other forms are found in NE Africa, among the Arizona Indians, and in India. Their range is as much as 200 yds.

**Boone, Daniel** (1731-1820), American pioneer, has become an almost legendary hero of the USA. He was American-born of English stock, and throughout his life battled against the Indians and assisted in opening up new territory to the W of the Appalachian

Mountains. He sat for a time as a representative in the Virginia legislature. It is indisputable that he was as highly skilled as an Indian in the arts of a backwoodsman—tracking, hunting, and trapping, with great powers of physical endurance.

**Bootes** (astron.), *see* CONSTELLATIONS

**Booth, Edwin Thomas** (1833-1893), American actor, manager of Winter Garden Theatre, New York, 1862-8. He built "Booth's Theatre" in 1869, with a repertory company playing Shakespeare. He visited London in 1851, 1880, and 1882. Booth excelled in Shakespearean parts, especially Hamlet. His father, JUNIUS BRUTUS BOOTH (1796-1852), was a well-known English actor who migrated to the USA in 1821. Edwin's brother, JOHN WILKES BOOTH (1839-1865), also an actor, assassinated President Lincoln.

**Booth, Wm.** (1829-1912), founder of the Salvation Army (*q v*). At first a Wesleyan, he went over to the Methodist New Connexion in 1849 and was ordained minister. He left them in 1861, and in 1864 founded the E. London Revival Society, and in 1878 the Salvation Army, of which he became the first General. At first opposed and ridiculed, in 1902 he was officially invited to the coronation ceremony of Edward VII, when the opposition to the Salvation Army had died down.

He was a great open-air preacher, and made many converts thereby.

**Booth, William Bramwell** (1856-1920), general in the Salvation Army, was chief of staff from 1880 to 1912,



Bramwell Booth

when he succeeded his father William Booth as general. In 1908 he was deposed by the Army High Council who objected to the idea of the leadership becoming hereditary in one family and General L. J. Higgins was elected in his stead. Booth is remembered especially for his work against the White Slave Traffic and he was instrumental in securing the passage of the Criminal Law Amendment Act of 1885.

**Boothia Felix** Canadian peninsula in the extreme N between Moss Strait and the Gulf of Boothia. It contains Cape Murchison the N point of Canada. It was named after Sir Felix Booth who financed the expedition that led to its discovery (1830). It was here that the position of the N magnetic pole was first determined by Ross. Area c 13 000 sq m.

**Bootle** suburb of Liverpool Lancs whose chief industries are shipbuilding and repairing flour milling timber work and metal founding. There are large docks and warehouses for the storage of goods. Pop (1931) 76 799.

**Bootlegging** illicit trade in alcohol in those countries in which its sale is prohibited notably in the United States after the prohibition law of 1900. The name is derived from pioneering days when alcohol intended for illegal sale to Indians was often concealed in the legs of boots. Bootlegging was principally conducted across the Canadian frontier by night or from vessels under foreign flags anchored just outside the 12 m limit whose cargoes were brought to shore by fast motor boats. With increasing efficiency on the part of the patrol boats bootlegging took the form of illicit home manufacture for which alcohol was fraudulently deflected from industrial uses under the permit scheme.

**Boots and Shoes** s. SHOES AND LOORS.

**Boots, Repair of.** To repair boots and shoes with leather the following equipment or its equivalent is necessary.

Shoemaker's hammer  
2 shoemaker's knives (one with triangular blade)  
Shoemaker's rasp  
A straight awl  
Sandpaper  
Clazing iron preferably of the combination type  
Shoemaker's sink  
Heelball  
Rivets  
Iron foot or last

**To fix new Sole.** A pattern of the sole is made by placing a piece of paper over the shoe or boot and marking it the exact shape with the file side of the rasp. Smooth grained leather is soaked for a few minutes placed over a flat iron and hammered all over to close up the pores. The old sole is damped and removed cutting it at the waist line on a slant. Repair middle sole if necessary by riveting a thin patch. Taper off piece of sole leather at waist and the under part of new piece to fit on to it. Nail new sole into place making the holes for the rivets with the awl if necessary putting the line in across the waist first and another rivet near the toe to keep in position.

Should the second lift of the heel be worn the thin part is cut off and a half lift nailed in its place. All that remains is to apply a professional finish by smoothing the edges the surface of the sole and rivets with buffing knife sandpaper and rasp respectively. Inking and heelballing and ironing give the final touches.

Rubber or composition soles can be applied similarly and stuck on according to directions supplied with them. Rubber heels are usually supplied with a central nail or with holes into which they may be driven.

**Bopp Franz** (1791-1866) German philologist professor at Berlin (1811) postulated a common origin of the German Latin Greek Persian and Sanskrit languages and published several books which described the grammar and phonetics of the conjectural tongues from which those languages sprang. His works in-



cluded his monumental *Comparative Grammar* (1833-52), and also Latin translations of parts of the *Mahabharata*

**Boracic Acid**,  $H_2BO_3$ , derived from the element boron (*qv*). Also known as boric acid, used, although to a diminishing extent, as a preservative for foodstuffs, also medicinally as a douche for mucous membranes and in the form of ointment

**Boracite**, a naturally occurring mixed chloride and borate of magnesium. It is found chiefly in Germany, and is used as a commercial source of boron

**Borage** [*BO'RIJ*], herbaceous plant of the Boraginaceæ family, characterised by hairy stems and blue flowers. Borage, anchusa, comfrey, viper's bugloss, heliotrope, and the true forget-me-not are typical

**Borah**, Wm Edgar (*b* 1865), American senator since 1907, barrister, 1889, a leading Republican statesman. Borah opposed the nomination of Taft in the 1912 presidential election, and disagreed with Roosevelt's Democratic policy, criticised the formation of the League of Nations, and was instrumental in securing America's refusal to join, initiated the *Washington Naval Conference* (1922), chairman of Foreign Relations Committee under Hoover

**Borax**, sodium borate, used as a flux in brazing and in the preparation of optical glass, and as a water-softener (*see BORON*)

**Bord and Pillar System**, *see* COAL-MINING

**Bordeaux**, city and port of W France, Bordeaux is of considerable maritime importance, its port being able to accommodate 1500 vessels. It is an active centre of the wine trade and subsidiary industries. Shipbuilding and refitting also flourish. There is a Gothic cathedral, a university, observatory, and 4 old gateways. From 1152 to 1453 Bordeaux belonged to English Kings, and for a time was the seat of the Court of Edward the Black Prince. Served as a temporary

seat of Government during the early part of the World War, when the French Government left Paris. Pop (1931) 262,990

**Bordeaux Mixture**, an insecticide spray made from copper sulphate and lime (*see COPPER*)

**Borden**, Mary, Anglo-American novelist, married, in 1918, Brigadier-General Spears. Her works include *Three Pilgrims and a Tinker* (1924), *Flamingo* (1927), *A Woman with White Eyes* (1930), *Sarah Gay* (1931)

**Borden**, Sir Robert Laird (*b* 1854), Canadian statesman, barrister, 1878, M P for Halifax, 1896, leader of Conservative opposition from 1901, and Premier, 1912-19. Borden was a keen imperialist and opposed Laurier's policy. Prime Minister throughout the World War, he represented Canada at the Peace Conference

**Bordighera** [*BORD-I-GAR'A*], winter resort on the Italian Riviera, famous for the beauty of its gardens. Flowers are grown and exported. Pop c 5500

**Bordone**, Paris (1500-1571), Venetian painter, pupil of Titian. His output was large, and he is represented in galleries in Paris, London, Berlin, Boston, Philadelphia, among many others. His subjects were varied, and his portraits were especially fine

**Bore**, *see* GEOGRAPHICAL TERMS, GLOSSARY OF

**Borghese**, an Italian family, originally Siennese, of whom one member was Pope, 1605-21 (Paul V). The family became prominent in Rome, and Camillo, Prince Borghese, married a sister of Napoleon in 1803, afterwards being made Governor in Piedmont and Genoa. The famous Borghese Art Collection is still in Rome

**Borgia**, Cesare (1476-1507), son of Pope Alexander VI, and an ambitious political schemer. Borgia was made cardinal by his father in 1492, was papal legate in Naples and France 1497 and 1498, and succeeded in getting a promise of French support in increasing papal Italian possessions, conquered Romagna and other Adriatic

provinces but on Alexander's death (1503) lost power under succeeding Popes escaped from prison in Spain and was killed fighting for the King of Navarre

**Borgias, The**, a Spanish family famous in Rome in the 15th and 16th cents Two of them held the Papedom Alphonso as Calixtus III (1455-8) and Rodrigo as Alexander VI (1492-1503) See also BORGIA

**Boric Acid** see BORACIC ACID

**Boring** into the earth is an operation performed in order to discover the nature of the underlying strata and to search there for water or for oil and other minerals In the case of water and oil the bore hole suffices permanently as a means for bringing the substance required to the surface though it may be enlarged Holes up to 50 ft in depth in suitable ground can be bored by hand by means of the earth auger which is made in various sizes up to about 6 in and can be used where large stones are not likely to be encountered It brings up a sample and can often afford valuable information

For deeper holes the softer overlying soil is penetrated by driving in pipes the material entrapped in these being removed either by scooping out or by washing out When hard rock is reached drilling is effected by various methods based upon the impact or "drifter" principle known to everyone in the form of the domestic tool used to make holes in brick walls to take screw plugs A heavy drifter is raised and allowed to fall and at the same time rotated As the bit goes down it is held by either rods or better a rope It is thus that most prospecting and boring for oil and water is done with the rope the force of the blow is determined by the weight of the bit which is anything from 3 to 8 in in diameter The usual speed of working varies between 1 and 2 ft. per hour

The most modern and powerful tool is the rotating diamond drill which

will penetrate at twice the above speed very hard rock and bring up a clean undisturbed core which provides an exact sample of the strata at known depths The chips are removed continuously by forcing water down the rod carrying the drill the water returning by the space already drilled Enormous depths have been reached by means of the diamond drill in S Africa up to nearly 6000 ft It is very difficult however to maintain reasonable straightness in boring

**Boris III** (b 1894) Tsar of Bulgaria since the abdication of his father Ferdinand in 1918 served in the First Balkan War (qv) and in the World War He married in 1930 Princess Giovanna of Italy

**Boris Godunov** (1551-1605) Tsar of Muscovy guardian of Theodore who came to the throne in 1584 and on Theodore's death (1598) elected Tsar He pursued a peaceful policy He is the hero of an opera by Musorgsky

**Borneo** a large island (830 m long by 600 m broad) in Malay Archipelago Bounded E by Celebes Sea, and S by the Java Sea Area 289 860 sq m. It is divided into (1) Dutch Borneo which occupies about two thirds of the island (2) N Borneo (3) Brunei and (4) Sarawak. The country is mountainous and Kinabalu (13 698 ft) is the highest peak. Kapuas Schwaner and Müller are mountain ranges in the interior Important rivers include the Kapuas, Baito and Sarawak At Sandakan, on N coast is a fine natural harbour The rainfall of the island is heavy and the climate damp and hot Fauna include the rhinoceros orang utan and python. The flora is luxuriant the forests producing ironwood ebony and *kapang* Fruits include bananas oranges melons and pineapples Camphor gutta percha rubber rice sugar tobacco pepper indigo and coffee are also amongst the important productions of the island The mineral wealth is large and includes gold diamonds, iron, coal and copper

Amongst the industries of Dutch Borneo is the production of oil

BRITISH NORTH BORNEO, area c 31,106 sq m, occupying N part of island. The chief towns are Sandakan and Jesselton. The country is mainly hilly. Pop (1931) 270,220

DUTCH BORNEO is the largest and most valuable part of the island, occupying the SE and S Area, 200,000 sq m. The largest town is



Borneo Dyak Belles

Bandjermasin, on S coast. Pop (1920) 1,625,000

**Borneol** (Borneo camphor,  $C_{10}H_{17}(OH)$ ), an alcohol, derived from the *terpenes* (*qv*) found in certain Oriental trees. It has many of the same uses as ordinary camphor, *eg* in the manufacture of celluloid, in perfumery, etc. Medicinally borneol is employed as a sedative.

**Bornholm**, Danish island in the Baltic between Sweden and Germany. The island is hilly and picturesque, and a popular holiday centre. Minerals

include porcelain, clay, marble, and a little coal. The chief crops are oats and flax, and the leading industries are fishing, earthenware, and clock-making. It became Danish in the 16th cent, Swedish in the 17th, and was later returned to Denmark. Area, 221 sq m, pop c 45,000.

**Bornu**, district of Sudan SW of Lake Chad, now partitioned between England and France. The region is sub-desert in character, wild cotton and indigo grow in places but lack of perennial rivers hinders cultivation. There is a wet season from June to September. The inhabitants are negroes, although intermarriage with the Berbers of the N has taken place, the prevailing religion is Mohammedanism, and the district was formerly a sultanate. The greater part of Bornu is now absorbed in British Nigeria. Pop c 5,000,000.

**Borodin, Alex. Porfirievich** (1834-1887), one of the most important of the "new" Russian composers of the 19th cent, was born in St Petersburg (Leningrad). His finest work, *Prince Igor*, is a brilliant essay in eastern colour and atmosphere. His quartet in D major also shows an E influence, notably in the *Nocturne*, which has become a popular excerpt. His other well-known work is his melodious 2nd Symphony in B minor. On his death he left Rimsky-Korsakov and Glazunov to complete his unfinished *Prince Igor*.

**Borodino, Battle of** (Sept 7, 1812) the French under Napoleon I drove the Russians under Kutusov from a strong position, but at nightfall left them in possession of the field. The battle is also known as the Battle of the Moskva.

**Boron**. For the characteristics of boron see the article **ELEMENTS**.

Boron does not occur in nature in the uncombined state, and it is chiefly found in the form of *borax* or *tincal*, a sodium borate having the formula  $Na_2B_4O_7 \cdot 10H_2O$ . This occurs to a considerable extent in California, whence a large part of the world's supply is derived. Borax is also obtained from

other boron-containing minerals by boiling them with sodium carbonate. Boric acid  $H_2BO_3$  is found naturally in steam jets (solfioni) which occur in Tuscany. The boric acid is recovered by successive concentrations of the condensed steam. The best method for the preparation of the element itself is to reduce the trioxide with magnesium powder. Boron exists in two forms: the amorphous, which is a brown powder, and the metallic (boron is usually regarded as a non-metal).

Boron as such is used to a small extent for adding to metallic castings in order to increase their strength, but its industrial importance rests principally on the utilisation of its compounds.

**Borotra, Jean** (b. 1900) French lawn tennis player. Won the singles championship at Wimbledon in 1924 and 1926 and the doubles championship with René Lacoste in 1925 and with J. Brugnon 1926. He first appeared in the French Davis Cup team in 1921 and was champion of France 1924.

**Borough** (AS *burh*) originally a fortified place; the word was applied generally and without definition to all towns enjoying some measure of self-government throughout the Middle Ages. Their history may be said to begin with the Danish invasions of the 8th cent. when the shires gradually developed around the *burh* or fortress which in 900 was granted its own law court. The feudal system which originated at the Conquest (1066) was a blow to burghal self-government, but the towns were gradually successful in obtaining charters and grants which recognised their privileges from the king or overlord. The privileges included the holding of markets and fairs, separate jurisdiction of assessment and the formation of merchant guilds. The last named were a great source of power and with the new borough organisation under a mayor laid the foundations for a large measure of self-government. By the 17th cent. the governing powers of the guilds had been handed over to the borough corporation of an elected

mayor, aldermen and councillors. These corporations became gradually more exclusive and less subject to the will of the ordinary burghers. In 1835 the status of a *Municipal Borough* was officially laid down in the Municipal Corporations Act, while the Reform Act of 1832 removed the political corruption and other abuses attached to close corporations and disenfranchised a large number of decayed or rotten boroughs. To-day a borough is a town or place subject to the Municipal Corporations Act 1888 with a common seal and a council consisting of mayor, aldermen and councillors; the latter elected by the burgesses, the former from and by the council itself. The mayor serves one year, the aldermen six, the councillors three, one-third of the last named retiring annually. The Local Government Act of 1888 allowed for the creation of *County Boroughs* from ordinary boroughs of over 50,000 population (now 25,000), the former enjoying powers equivalent to those of county councils. *See also* LOCAL GOVERNMENT.

**Borough English** *see* TENURE

**Borromeo, Carlo** St. (1538-1584) Cardinal and Archbishop of Milan. He was noted for his piety and for the introduction of many reforms into the diocese of Milan. He was a keen educationalist and strove to combat the ignorance of the clergy by founding schools and colleges.

**Borrow** **Geo. Henry** (1803-1891) traveller and author, understood twelve languages before he was 18 and took up translating. In 1828 he began his wandering life and set out to tramp



George Borrow

through England and Wales. Returning from Russia, where he had stayed from 1833 to 1835, he became an agent of the Bible Society, and set out for Spain, Portugal, and Morocco. In 1840 he returned and settled down to write his famous accounts of his adventures. *The Bible in Spain* (1843) was a great success, but *Lavengro* (1851) and *Romany Rye* (1857) were less popular. The open-air fervour and the hatred of conventions and respectability which Borrow infused into his work offended contemporary readers, but *Lavengro*, at least, is to-day a classic of its kind, and is still widely read.

**Borstal Institution**, a kind of reformatory in which young offenders, whilst detained, receive industrial training and other instruction, and are subject to such disciplinary and moral influences as will conduce to their reformation. The name is derived from a large juvenile-adult reformatory opened at Borstal, near Rochester, in 1901. These institutions are not intended for first offenders, but for young persons—mostly guilty of larceny—of the hooligan type who are drifting into a career of crime. The minimum period of detention now imposed in practice is 3 years, and is applicable to persons between the ages of 16 and 21, convicted on indictment of an offence punishable with penal servitude or imprisonment, or convicted before a court of summary jurisdiction of a second offence punishable with at least one month's imprisonment.

**Bort**, the name given to small black diamonds which are of no value for decorative purposes, but, on account of their hardness, are used as facings for rock-drills and, in the crushed form, as abrasives in diamond-cutting and polishing. They are also known as *carbonado* (See CARBON, TECHNICAL FORMS OF).

**Borzoi**, a large greyhound, standing about 30 in high, with a long silky coat. It is used as a show dog in this country, and was originally imported from Russia, where it was employed for hunting wolves, which, on account

of its great speed, it can run down in the open.

**Bose**, Sir Jagadis Chandra (b 1858), Indian scientist, has published many works on plant physiology. For the study of plants, he has designed certain instruments, of which the best-known is the crescograph, which can magnify movement 100,000 times.

**Bosh**, see IRON AND STEEL.

**Bosnia-Herzegovina**, two provinces formerly part of the Austro-Hungarian Empire, now incorporated in Yugoslavia by the Peace Treaty of 1919. Bosnia, the more important of the two, has an area of 16,206 sq. m. and a pop. of (1931) 1,691,003. It is largely forest land, with iron deposits at Vares and Lyubija. Sarajevo is the capital. Pop. (1931) 78,182.

Herzegovina, which lies S of Bosnia, occupies 3562 sq. m. and has more cultivable land. The chief crops are barley and tobacco, wines and spirits are also produced. Mostar, on the Narenta, is the capital. In both provinces there is a large Mohammedan population. Under Justinian the S.W. part of the country embraced Christianity. In 1463 Bosnia became tributary to Turkey and was annexed in 1528. The provinces, previously under Turkish rule for many centuries, were annexed by Austria in 1908 and held until the World War.

**Bosnian Crisis**, the second of the three crises occurring before the World War, which served to antagonise the two groups into which Europe was divided (see also ALGERAS CONFERENCE and AGADIR). Under the Treaty of Berlin, 1878, Austria-Hungary had been given the right to administer Bosnia and Herzegovina under nominal Turkish suzerainty. In 1908 Austria announced the annexation of these territories. England protested, and demanded a conference. Thus Austria refused, but offered a monetary compensation to the Sultan. The Triple Entente was not prepared to fight over the incident, and Austria had her way. Serbia was exasperated, and anti-Austrian propa-

ganda was carried on by influential Serbs both inside and outside Austrian territory. It was this Austro-Serb conflict that precipitated the war in 1914.

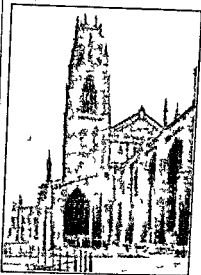
**Bosphorus**, Turkey narrow straits connecting the Black Sea with the Sea of Marmora. In appearance it resembles a winding river valley and is deep enough for ships of any size. The banks on both sides are well timbered and dotted with habitations. It was well fortified at the Black Sea entrance in 1914. Full length 16 m. greatest breadth 3000 yds.

**Boss** in architecture is an ornamental projecting centre piece in vaulting usually found in Gothic buildings. Fine examples may be seen in Westminster Abbey.

**Bossuet, Jacques Bénigne** (1627-1704) French author and divine first became famous as a preacher. After his appointment as tutor to the Dauphin he began to write. His publications include histories of France and of the Church and in 1671 his monumental *Exposition de la Foi Catholique* appeared. He was involved in many disputes and used questionable methods in his controversies with Malebranche and Fénelon. Best known of his works is perhaps his *Oraisons Funèbres*.

**Boston** (1) Port and capital city of Massachusetts, USA, on Boston Harbour 6½ m. from the sea at mouth of Charles and Mystic Rivers. The dry dock accommodates the largest liners. It is a noted educational centre containing Boston Latin School founded in 1635, America's oldest High School, while Harvard University is in Cambridge just outside the city. The public library, one of the most famous in the world, contains over a million volumes. It is an important railway centre. Printing and publishing, clothing, leather and confectionery are important industries. There are art galleries and museums. Symphony Hall is the home of the famous Boston Symphony Orchestra. Pop. (1930) 781,100.

(2) Port in Lancs on R. Witham. Boston owes its name to St Botolph who in A.D. 654 founded a monastery here. There are many old buildings notably St Botolph's Church whose tower is known as Boston Stump, a 15th cent. Guildhall, Grammar School and Shodfriars Hall. Pop. (1931) 16,900.



Boston, U.S.A.

**Boston Tea Party** name given to the action of the men of Boston, USA, who on December 16, 1773, boarded 3 English ships in Boston Harbour and emptied the cargoes of tea into the sea as a protest against unfair taxation by the Home Government.

**Boswell James** (1740-1795) author of the *Life of Dr Johnson* (1791) whom he first met in 1763. His only successful book apart from the *Life* was an *Account of Corsica* (1768). In character he was dilatory and extremely self-indulgent except in the company of Dr Johnson. With him Boswell toured the Hebrides in 1773 and both travellers wrote accounts of their journey. Boswell's

vanity caused him to publish many verses and pamphlets that add nothing to his reputation, which, indeed, rests solely on his life of Johnson, a detailed account of the conversations between Johnson and his friends, which contains some of the finest dialogue in English literature

**Bosworth Field** (Wars of the Roses) (Aug 22, 1485) Henry Earl of Richmond (Henry VII) defeated Richard III, who was slain. The battle was lost through the treason of Lord Stanley and Sir William Stanley, who deserted at a critical moment to Richmond, on whose head the crown (picked up on the battlefield) was placed, when he was at once saluted king by the whole army

### Botanical Terms, Glossary

**Abscission layer** a layer of parenchymatous (*q v*) cells formed at the base of the leafstalk, shortly before the leaf is shed, by means of which stalk and axis separate cleanly

**Accessory buds** additional buds developing in the axil of a leaf, found in many liliacea and in honey-suckle and laburnum

**Acropetal**, developing from the apex outwards, said of the order in which the parts of a plant develop

**Actinomorphic** of radiated shape, applied to the shape of flowers

**Acuminate** tapering to a sharp point

**Adventitious** applied to a bud appearing elsewhere than in the axil of a leaf, or to roots appearing on stems or leaves

**Æcidiospore** a binucleate reproductive spore produced in an æcidium

**Æcidium** the fruiting body of the rust fungi which are parasitic on leaves of flowering plants, containing a large number of spores produced by division of a large cell which is formed by fusion from two cells whose contents unite but whose nuclei do not fuse

**Aerenchyma** tissue with large intercellular spaces serving for ventilation or storage of gases

**Ærotropism** a state of sensitiveness to gaseous differences which leads to

irritable movements, observed in pollen tubes, roots, and shoots

**Æstivation** the arrangement of flowers inside buds

**Allogamy** cross fertilisation of plants

**Alternate**, the arrangement of leaves on a stem, first one side then the other

**Alternation of generations** two generations differing in their modes of reproduction, of morphologically distinct and independent individuals. Thus the asexually produced spores of the fern plant grow into a small plate-like green structure which bears sexual organs, and an egg-cell is fertilised and grows into a new fern plant. This phenomenon is clearly seen in mosses and ferns, and occurs in seaweeds, it is remarkably developed in the rust fungi, and occurs also in flowering plants, though it is more difficult to follow all the stages in higher plants

**Amitosis** a direct nuclear division or fragmentation, not passing through the several stages of mitosis, and not followed by cell division

**Andrœcium** the stamens or male organs of a flower collectively.

**Anemophilous** describes plants which are wind-pollinated. the male inflorescence is usually in the form of a longer or shorter catkin with a large number of microsporophylls, so orientated that after the sporangia (*q v*) have opened the pollen can be readily carried away by the wind. The pollen grains are light and smooth, and even have two wing-like sacs in some conifers, which enable them to remain longer suspended in the air. The female flowers are not brightly coloured, and have no nectaries, and the stamens have long feathery hairs, or are elongated or brush-like. Flowering is over before the leaves are open or fully expanded

**Angiosperm**, plants whose seed is protected by a seed-vessel, that is, the flowering plants

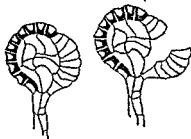
**Anisophylly** the bearing of diversely formed foliage leaves in the same

zone but on the two sides of a shoot which thus becomes dorsiventral. An adaptation usually in response to peculiar one sided light conditions.

**Annual** a plant living for one year only and completing its whole life cycle from germination to the production of seeds in that time.

**Annual rings** seen on cross sections of the wood of gymnosperms and of most dicotyledons are due to a periodic activity of the cambium or wood producing cells induced by seasonal climatic changes. In spring when new shoots are being formed wider and thinner conducting vessels and tracheids are developed while later in the season narrow elements are formed which impart to the stem its necessary rigidity. The contrast in structure of the spring and autumn wood is visible to the naked eye and the sharply defined annual rings are a means of computing the age of a tree.

**Annulus** a row of thickened cells forming a vertically placed semi circle at one edge of the biconvex stalked sporangium of a fern. The outer walls of the annulus cells are thin but the inner and radial much thickened. On exposure to



Annulus.

dry air the cells gradually lose water. The adhesion of water to the wall and the molecular cohesion of water are very great (more than 300 atmospheres) and the thin cell wall is pulled inwards as the volume of

cell contents decreases. The curved annulus is therefore pulled towards a straight and upright position and the remaining thin walled cells of the sporangium split to liberate the spores.

**Anther** two pairs of pollen sacs joined by connective tissue and with the filament forming the stamen. The wall of the sac breaks down and liberates pollen grains.

**Antheridium** the organ in lower plants in which the male cells become differentiated and mature usually a stalked egg shaped capsule with a wall of sterile cells enclosing large numbers of cells which become antherozoids.

**Antherozoid** a naked cell consisting of protoplasm and a nucleus bearing male characters and cilia or protoplasma threads by which it swims to reach the female cell. Fertilisation of the egg cell of lower plants thus requires the presence of water.

**Apetalous** without petals.

**Apoecarpous** carpels free from one another not joined together.

**Apogamy** the development of an embryo from a vegetative cell within the embryo sac and without the intervention of a male cell. A phenomenon distinct from parthenogenesis (*q.v.*)

**Apospory** the origin of a plant of the sexual generation from vegetative and not spore tissue of the sporophyte plant.

**Archegonium** the female reproductive body in some lower plants such as the liverworts mosses and ferns also in the conifers a multicellular flask shaped structure containing the oosphere or egg cell and several auxiliary cells.

**Auricle** a dry covering of some seeds as mace.

**Ascending** applied to stems which first lie prostrate on the ground and then rise perpendicularly.

**Ascus** a tubular sporangium containing a definite number (usually 4) of spores the characteristic reproductive structure of a large group of



fungi, including yeast and the fungus of ergot

Assimilation the process whereby carbon dioxide is absorbed by cells of the plant and transformed into starch by the action of light

Awn a stiff bristle, as in barley

Axil the angle between a leaf and the stem

Axillary growing in an axil

Bacterium an organism very low in the scale of evolution, of extremely small size, not possessing chlorophyll (*q v*) Bacteria are unicellular, spherical, rod-shaped, or rarely spiral, they multiply by division and possibly by a sexual process, the presence of a true nucleus in some bacteria was demonstrated in 1931, contrary to all previous belief

Barren bearing stamens, but no pistil

Bast a tissue consisting of long tubes through which the products of assimilation are transferred in the plant

Biennial lasting 2 years

Bifid two-cleft

Bipinnate twice pinnate (*q v*)

Bipinnatifid twice cut in a pinnate manner

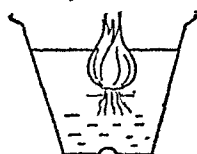
Border the expanded part of a corolla (*q v*)

Bract small leaf at the base of a flower stalk

Bud the delicate growing point of a stem and its immature leaves which form a protective covering

Bud-scales, modified leaves reduced to scales which enclose a resting bud through an adverse season

Bulbil a bud produced in the axil of a leaf which is adapted to break away and form roots in the soil and



Bulb

grow to a new plant  
Bulb an underground bud in which the stem is much reduced and some of the leaves or leaf bases are

enlarged and fleshy, and contain food stores

Caducous falling off very early, as the sepals of the poppy

Calciphobe applied to plants which grow only in an acid soil and never in one containing lime

Callus a tissue formed by active cell division just below a wound surface, to prevent loss of water and entry of bacteria and other parasitic organisms

Calyx the outer case or sepals of a flower

Cambium, tissues within a plant which produce new wood or other tissues

Capillary hair-like

Capitate round like a head

Capitulum the inflorescence (*q v*) of the Compositae (daisy and marigold family), in which a large number of reduced flowers or florets are crowded on to an expanded shortened stem or receptacle

Capsule a dry, many-seeded fruit formed from two or more joined carpels

Carpel a modified folded leaf bearing ovules, a simple ovary with style and stigma

Catkin an inflorescence of flowers of one sex, bearing either stamens or carpels, which separates from the parent branch by a joint when its purpose is fulfilled

Chromosome a filament within a dividing nucleus, of irregular outline, often appearing like a chain of irregular beads, generally believed to carry the factors of inheritance

Ciliated fringed

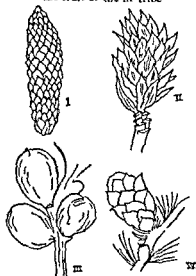
Cilium a protoplasmic thread put forward by some unicellular aquatic organisms by means of which they swim and direct themselves

Circinate curled, like a young fern

Claw the base of a petal

Cleistogamous flower one which is small and inconspicuous and never opens, serving only for self-fertilisation Cleistogamous flowers are found on violet plants late in the autumn and are the chief ones to set seed

Cone the fruit of the fir tribe



Co. A.

I Spruce Fir II Pin III Yew IV Juniper

Corm the underground part of certain plants such as the crocus a shortened more or less spherical stem from the upper surface of which



Sagitt. Corm and Chain of Corms.

leaves and flowers are put out and from the base of which spring fibrous roots. The stem contains food reserves and is wrapped in protective scales. Corolla: the inner leaves or petals of a flower

- Cortex the outer tissues of a root or stem  
 Corymb an inflorescence in which the upper flowers are sessile and the lower ones stalked so that the flowers are all at the same level  
 Cotyledon a tiny leaf formed within a seed  
 Crenate scalloped at the edge  
 Cryptogam lower plant moss liverwort fern  
 Culm the stalk of grasses  
 Cuticle the thin outer skin of a plant  
 Cyme irregularly branched inflorescence in which the terminal flower opens first  
 Deciduous soon falling off  
 Decurrent of leaves when the midrib ( $q\ v$ ) is attached to the stem for some distance and the expanded basal part of the blade appears as winged appendages of the stem  
 Dichasium an inflorescence in which each branch divides into two equal ones  
 Dichlamydeous having both corolla and calyx  
 Dichinous or unisexual applied to the flower  
 Dicotyledon plant whose seed characteristically contains two embryo or seed leaves  
 Didynamous having 4 stamens 2 long and 2 short  
 Dioecious plants having the stamens and carpels in separate flowers and on different plants  
 Diploid nucleus has the double pair of chromosomes characteristic of the cell in the vegetative state (see HAPLOID)  
 Diplostemonous flowers have 2 whorls of stamens in the androecium ( $q\ v$ )  
 Disk the central part of a composite flower a flat space surrounding the ovary  
 Drupe a nut enclosed in pulp  
 Egg-cell (or oosphere) the female cell which when fertilised gives rise to an embryo and new plant.  
 Emarginate notched  
 Endosperm a food storing tissue within seeds

**Ensiform** sword shaped.

**Epidermis** the outermost tissue of a plant

**Epigynous flower** one in which the carpels are situated below the petals and sepals

**LIGHT**



**DARK**



**Epiphyte** a plant growing on another but not taking nourishment from it as does a parasite

**Etiolation** the state of plants deprived of light, when the stems elongate and the leaves be-

**Etiolation in a Bean Seedling**

come small and far apart and succulent, and the whole changes to a yellowish colour

**Exserted** protruded beyond the other parts

**Extrorse** anthers so placed that they burst outwards and do not project their pollen towards the stigmas of the same flower

**Farinaceous** abounding in flour

**Fascicled** growing in a dense tuft

**Fertile** bearing carpels and producing seeds

**Floret** one of the small flowers composing a "flower" of the Composite family

**Flower** consists of stamens or carpels, or both, and envelope of petals and sepals

**Follicle** a dry many-seeded fruit formed from one carpel and splitting down one margin (e.g. delphinium)

**Free** of petals or sepals, not united

**Fron**d . the leaf of a fern

**Fruit** the seed with its covering

**Fungus** a non-green, saprophytic or parasitic plant, of low place in the scale of evolution.

**Furcate** . forked.

**Fusiform** . spindle-shaped

**Gall** an excrescence formed as a result of injury by an insect which punctures leaf or stem to insert eggs

**Gamete** a naked sexual cell bearing male or female characters, consisting of nucleus and a little cytoplasm, with no cell wall

**Geotropism** . the response of the plant to gravity, which causes the root to grow downward and the stem upward

**Germination** the development of the embryo contained within the seed into a self-supporting plant

**Gibbous** of flowers, swollen at the base (e.g. snapdragon)

**Glabrous** Geotropism shown in a Bean Seedling

a perfectly smooth and hairless surface

**Gland** a cell containing some secretion

**Glaucous** covered with a pale-green bloom

**Glume** the chaff of the grasses

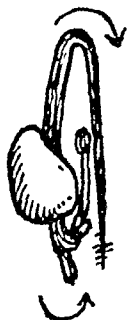
**Guard cells** specialised cells in the epidermis which control the passage of gases and water vapour into and out of the plant

**Gynæcium** the carpels or female organs of the flower

**Halbert-shaped** arrow-shaped, with the barbs turned outwards

**Halophyte** plant whose characteristic habitat is a soil rich in salts

**Haploid nuclei** contain one set of chromosomes only The haploid



- state is characteristic of nuclei before sexual fusion when the chromosomes from each gametal nucleus rearrange but do not fuse and the zygote or product of sexual fusion contains a diploid nucleus with double complement of chromosomes
- Hastate** arrow shaped
- Hauatorium** a probing cell by which a parasitic plant penetrates to the food supply of its host to withdraw food therefrom to itself
- Herbaceous** having a succulent stem
- Hermaphrodite** flower or plant in which both male and female organs are present
- Hilum** place of attachment of the seed within the ovary
- Hispid** bristly
- Hydathode** a special structure for the secretion of water
- Hydromorphy** structural adaptation of plants to a life in water
- Hydrophyte** plant living in water
- Hydrotropism** the movement or growth of a plant towards a source of water
- Hypha** a cell tube in a fungus
- Hypocotyl** a zone of the stem of a seedling below the cotyledons
- Hypogynous** applied to a flower in which the petals and sepals are inserted below the carpels on the receptacle
- Imbricated** overlapping like the tiles of a roof
- Indehiscent** not opening with joints
- Inflorescence** the arrangement of flowers on a stem
- Insectivorous plant** one with special mechanisms to catch and digest insects to obtain nitrogen in a suitable form and therefore able to live in poor soil lacking in nitrates
- Integument** the outer covering of a seed
- Internode** the stem between nodes whence leaves spring
- Interruptedly pinnate** pinnate with smaller leaflets between
- Introrse** of anthers turned inwards in such a way that when ripe they project pollen towards the style
- Inversely *egg* shaped oval with the base narrower than the extremity
- Involucere** a whorl of bract, consisting of unequally sized petals
- Irregular** of flowers unequally divided
- Irritability** a property of living matter or protoplasm generally response by some vital action of motion nervous impulse etc to an external stimulus such as heat light chemical substance or friction
- Isogamy** fusion of sexual cells apparently similar in all respects and not morphologically differentiated into male and female.
- Labiately** lipped
- Laciniate** jagged
- Lamarckism** the theory of the inheritance of acquired characters
- Lamina** a plate the broad part of a leaf
- Latex** a liquid excreted into a special system of tubes within certain plants. White latex is exuded by dandelion and cherry stems or leaves if broken orange by the greater celandine yellow by members of the *pig* family
- Laticiferous tubes** those in which latex is stored in the plant
- Leaflet** a single portion of a compound leaf
- Legume** a long seed pod without a partition
- Lignin** a complex chemical substance deposited in the walls of cells to make them hard and woody
- Ligulate** strap shaped
- Ligule** a thin tongue like appendage at the base of some leaves especially grasses
- Limb** the expanded part of a petal
- Linear** very narrow with the edges parallel
- Lyrate leaf** a pinnatifid leaf with a rounded terminal lobe and smaller divisions near the base
- Marcescent** withering
- Mechanical tissue** layers of strong fibres disposed in stems or other organs to impart rigidity
- Medullary ray** the groundwork tissue

between vascular bundles in stem or root

Meiosis . reduction-division of nucleus

Meristem *see* CAMBIUM

Mesocarp the flesh of a plum or cherry fruit

Mesophyll the green cells of a leaf, in which starch is made from carbon-dioxide gas and water by the energy of light absorbed by the green substance or chlorophyll

Metabolism [META'BOLISM] the process within a living cell or organism of the synthesis of complex food materials from simple substances, or the breakdown of living protoplasm and foods into less complex substances

Micropyle the pore in a seed coat through which water enters

Midrib the principal vein of a leaf

Moniliform having the appearance of a necklace

Monochasium the branch system in which the main growth is carried on by a single lateral branch. Frequently this branch continues the direction of the parent shoot, the tip of which is displaced to one side

Monochlamydous having a single perianth, of petals or sepals

Monocotyledon a plant whose seed characteristically contains an embryo with one developed leaf. The large group of flowering plants comprising the lilies, orchids, grasses, etc

Monœcious plants having the stamens and pistils in separate flowers but on the same plant

Mucilage a gummy substance found in different parts of some plants

Mycelium the white threads forming the vegetative body of a fungus

Nectary any distinct organ in a flower containing honey

Nucleolus a central body of chromatin or deeply staining material within a nucleus

Nucleus a spherical, oval, or lenticular body within a cell, consisting of nuclear sap suspended in a fine net or reticulum of living substance. The nucleus is necessary for the

maintenance of life in the cell, and is probably the bearer of the hereditary characters

Nut a seed contained in a hard, dry shell

Obcordate inversely heart-shaped

Obovate inversely egg-shaped

Ontogeny the development of the individual

Oogamy sexual reproduction by morphologically different gametes, the female being larger and non-motile

Oogonium the structure in a lower plant within which the egg or female cell develops

Oosphere an unfertilised egg-cell.

Oospore a fertilised egg-cell.

Orbicular round

Ovary the lower part of a carpel containing the ovule

Ovule the embryo seed

Palaeaceous chaff

Palisade cell large brick-shaped cells of the mesophyll tissue of a leaf, within which starch or sugar is made

Palmate divided into 5 or more narrow lobes

Papilionaceous butterfly-shaped

Pappus a feathery appendage of the seed

Parenchyma ground tissue, irregularly shaped non-green cells within leaves, etc

Parthenogenesis the development of an unfertilised egg-cell into an embryo without the intervention of a male

Patent spreading

Pectinate divided like the teeth of a comb

Pedate palmate, with the outer lobes divided

Pedicle the stalk of a flower in a compound inflorescence

Peduncle a flower stalk

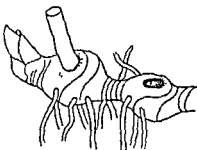
Peltate circular, with the stalk in the middle, applied to leaves

Perennial lasting many years

Perfoliate having a stem passing through a pair of leaves

Perranth a name sometimes given to the calyx or corolla, or both

**Pericarp** seed vessel the seed with its covering  
**Persistent** not falling off opposed to caducous  
**Petaloid** petal like  
**Petiole** a leaf stalk  
**Photosynthesis** the preparation of starch or sugar from carbon dioxide gas with the action of light  
**Phototropism** bending or moving towards a source of light  
**Phylloclade** stem modified to appear like a leaf as in butcher's broom  
**Phyllode** flattened leaf stalk bearing a much reduced blade and itself carrying out the functions of photosynthesis  
**Phyllotaxy** the arrangement of leaves on a stem  
**Pinnate** divided like a feather  
**Pinnatifid** lobed in a pinnate manner  
**Pistil** carpel  
**Placentation** the mode of arrangement of ovules within an ovary  
**Plasmolysis** a phenomenon of contraction of cell contents induced by strong solutions and by injury  
**Plumule** rudimentary bud in a seed  
**Pollen** the fertilising powder contained in the anthers  
**Pollination** the transfer of pollen from anthers to stigma  
**Premorse** as if bitten off  
**Prickle** a sharp point not having a woody centre  
**Protandry** the ripening of anthers before stigma in a flower a device to prevent self pollination  
**Pubescent** downy  
**Quinate** growing in fives  
**Raceme** an inflorescence with the youngest flowers at the top  
**Radiate** a term applied to the composite flowers the outer florets of which are larger than those of the disk  
**Radical** springing from the root  
**Radicle** the embryo root  
**Ray** the outer florets of a compound flower  
**Reflexed** bent backwards  
**Regular** equally divided  
**Rhizome** a subterranean, thickened stem



Rhizome or Root Stock of Solanum

**Ringent** gaping  
**Rostrate** beaked  
**Rotate** wheel shaped  
**Runcinate** pinnatifid with the lobes pointing backward  
**Sagittate** arrow shaped  
**Samara** winged seed of the ash sycamore etc  
**Saprophyte** a plant having no chlorophyll and living on dead organic matter as fungus  
**Scabrous** rough to the touch  
**Scandent** climbing  
**Schizocarp** a fruit which splits to disperse its seeds  
**Scion** a creeping shoot in horticulture a branch grafted on to a stock  
**Secund** all arranged on one side  
**Sepal** calyx leaf  
**Sessile** sitting destitute of a stalk  
**Setaceous** bristly  
**Siliqua** a long pod with a partition fruit of the cruciferous family (wallflower etc)  
**Spathulate** oblong but widening towards the end  
**Spermatozoid** see ANTHEROZOID  
**Sporangium** capsular structure containing spores  
**Spore** the asexually produced reproductive cell of a moss fern or liverwort  
**Spur** a sharp horn shaped swelling  
**Stamen** a male organ of a flower producing pollen in an anther borne on a filament  
**Stamode** a stamen like structure in which no pollen is produced

derived by degeneration from a stamen



Stipule.

Stellate star-shaped  
Stigma the summit of the carpel, which receives the pollen grain

Stipitate stalked  
Stipule bract at base of a leaf-stalk

Stolon a rooting scion

Stoma a pore in the outer skin of a leaf, through which gases are exchanged with the atmosphere

Style the middle part of a carpel

Subulateawl-shaped

Suture a seam or joint

Syngenesious united with the anthers

Tap-root the main vertical root

Tendrila twisted stalk, bearing neither leaf nor flower, usually a modified leaf or leaflet for climbing purposes

Terete long and cylindrical

Ternate growing in threes

Tetradynamous having 6 stamens, 4 long and 2 short

Thalamus the floral receptacle

Thallus a plant-body not differentiated into leaf, stem, and root

Thorn a sharp point having a woody centre

Throat the upper part of a tube

Tomentose covered with a thick cotton like growth

Transpiration the loss of water from the aerial parts of plants to the atmosphere

Trifid three-cleft

Truncate ending abruptly, as if cut off

Umbel the characteristic inflorescence of the carrot family in which a number of flower stalks spring from the same point on a main stem

Urcinate hooked

Vaccolate purple-colored

Vacuole a cavity within a cell the least watery part

Volute opening with a lobed

Vascular bundle the group of modified cells through which water, solutions, and the products of photosynthesis are passed about the plant

Vein the course of a vascular bundle in a leaf

Venation the arrangement of veins

Vermicular worm-like

Vernation the arrangement of leaves in a bud

Verrucose warty

Verticillate whorled

Vesicle a bladder

Villous shaggy

Viviparous producing young plants instead of seeds

Whorl three or more similar structures springing from the same point

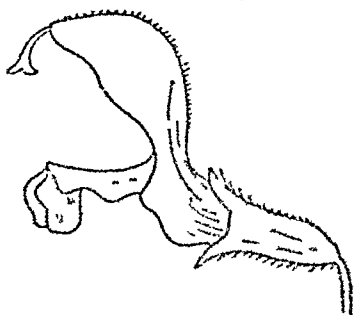
Xeromorphy structural adaptation to life in a dry place.

Xerophyte plant living under extremely dry conditions

Xylem wood vessels in stem, leaf, or root, through which water is passed up the plant

Zoospore a reproductive body of a lower plant, unicellular, often consisting of naked protoplasm, with the power of swimming

Zygomorphic of a flower, having one plane of symmetry only.



ZYGOMORPHIC FLOWER OF SALVIA

Zygote a zygote (2n) formed by the union of two male branches of a fungus

Zygote a fertilized female cell.

**Botanic Gardens** Dating from the formation of a medicinal garden by *Lorenzo de Medici* in 1530 the first public botanic gardens were established in Pisa by the university and in Padua in 1545. In France the two earliest were Montpellier (1598) and the *Jardin des Plantes* at Paris in 1610. It was at Oxford in 163 that the first English botanical garden was laid out. Later came Kew (1700) and examples at Madrid and Cambridge. The gardens in Regent's Park were opened in 1839.

**Botany** or the science of the plant has many branches such as morphology classification physiology plant biochemistry plant geography ecology genetics and palaeobotany. The herbalists were occupied with the supposed medicinal properties of plants sometimes ascribing these on the slenderest grounds such as a resemblance in shape between some part of the plant and the human body.

The first clear descriptions of plants and their parts (*morphology*) are found in German herbals of the 16th cent. Gradually from these descriptions of plants arranged alphabetically as by *Fuchs* (1542) or grouped as herbs shrubs or trees by *Boeck* systems of classification (*systematics*) arose. *Linnaeus* was the first to affirm that a natural system of plant arrangement existed and in 1738 he gave a list of 65 groups or orders which he looked upon as possessing natural affinities. He also introduced the binary method of naming plants still in use and accepted the theory of the sexual importance of the stamens basing his classification of plants on the number of stamens in the flower. Modern classification of higher plants is based on the number and form of both the reproductive organs of the flower and the stage of evolution of the sexual system of any plant is taken as indicating its relative position in the natural system.

**Plant Structure** The earliest forms of plant life were probably single cells every performed all the

functions of absorption synthesis and utilisation of food growth and reproduction. Two distinct types of primitive multicellular organisms evolved from the uncell one consisting of cells loosely held together by some enveloping material but distinct in their life processes from one another the other cells sharing a common wall. In these latter filamentous plants some division of labour occurred and from these primitive beginnings have evolved through vast periods of time the plant which consists of root stem and leaves the root anchoring the plant and absorbing water and salts from the soil the stem supporting both the green food making leaves and the leaves modified by other evolutionary processes to serve directly or indirectly only reproductive functions.

The plant cell consists of a living protoplasmic layer surrounding a vacuole of watery fluid and is usually enclosed in a wall of cellulose. The protoplasm is differentiated into cytoplasm and nucleus. The cytoplasm is of a more or less uniform gelatinous nature usually colourless. The nucleus is a spherical or ovoid body embedded within the cytoplasm or suspended by threads in the vacuole and consists of a membrane enclosing a network structure of fine plasma threads. The threads carry tiny granules of chromatin called chromosomes and are believed to be the carriers of inherited characters. The nucleus controls the living processes of the cell. The cell sap is a watery solution of sugars and mineral salts. The cellulose wall is usually more or less extensible a matter of extreme importance to the plant in its water economy. The wall allows passage of water dissolved sugars and salts into and out of the cell. The protoplasm is bounded by a delicate membrane at each surface and these membranes control the exchange of substances between the sap and the exterior. The permeability of these membranes to dyes has been exhaustively studied by American workers. The colouring matter



green cells, or chlorophyll (*qv*), is held within the network structure of tiny, rounded, or disk-shaped plastids, embedded within the cytoplasm of green cells, and the synthesis of starch and sugar from carbon dioxide and water takes place in these bodies. The energy necessary for this process is absorbed by the green substance from those light rays which reach the plastids through the superficial cells or epidermis of the plant.

**Botany Bay**, the site of Captain Cook's first landing on Australian soil (1770), in modern New S Wales, not far from Sydney. It was so named from the profusion of new flora found there. First used as a convict settlement, it later became a small manufacturing centre, and is now a local holiday resort from Sydney.

**Bot-fly**, also known as the Gad Fly or Warble Fly, insect (*qv*) of the order Diptera, parasitic on sheep, cattle, and horses.

In the case of the sheep, the fly lays its eggs in the nostrils, and the maggots crawl up to the bones of the forehead, where they may remain for about 9 months, giving rise to serious illness. In the horse, the fly lays its eggs on the skin, and the irritation caused by the maggot induces the horse to bite the spot, thereby swallowing the larva, which lives for a year in the stomach of its host without doing serious damage. The gad-fly of cattle is a more serious pest. The eggs laid on the skin hatch into maggots, which burrow under the skin, producing tumours or "warbles."

**Botha, Louis** (1862-1919), S African statesman and general, born Natal, had early commands in Boer War, 1899, chief Boer representative at the Vereeniging Peace Conference 1902, actively supporting co-operation with the British in an amicable settlement. Botha was first Premier of Transvaal 1907, first Premier of the Union of S Africa 1910, and announced adherence to the British Empire at the London Colonial Conference 1909. He suppressed internal disputes, putting down a rebellion early in the World

War, and conquered German SW Africa. He attended the Versailles Peace Conference, but died soon after returning to the Transvaal.

**Bothnia, Gulf of**, N part of the Baltic Sea, between Sweden and Finland. It is so named from the ancient territory of Bothnia, now incorporated in the two countries.

**Bothwell**, residential suburb of Glasgow, remarkable for its historical associations. Part of the parish church dates from the late Middle Ages, and there is a Roman bridge in the district. The Covenanters were defeated near-by in 1679. Pop c 61,000.

**Bothwell, James Hepburn, 4th Earl of** (c 1536-1578), Scottish political intriguer, 3rd husband of Mary Queen of Scots. Championed Mary against Elizabeth and Scottish nobility, was closely implicated in the murders of Rizzio (1566) and Darnley (1567). Bothwell surrendered after marching against Edinburgh, fled to Norway, Denmark, and then Sweden, was later imprisoned, and became insane.

**Botori**, a Japanese game played by 2 teams, usually about 100 aside. Each side defends a post about 8 ft high set in the ground, which the opposing side endeavours to pull down. The posts are set about 200 yds apart. Various mass formations are used, and players often climb over the heads and shoulders of their comrades in order to reach the opponents' post.

**Botticelli** [*pron* BOT-*i*-CHEL'-li], Sandro (c 1444-1510), Florentine artist, whose real name was Alessandro di Mariano dei Filipeppi, was a delicate child, the son of a tanner. In his boyhood he was looked after by an elder brother, who apprenticed him about the age of 14 to Filippo Lippi. He remained with this master as pupil and assistant for 8 or 9 years, and Lippi's influence is apparent in Botticelli's work throughout his life, though he became a greater artist than his master. One of Botticelli's earliest paintings is *Pallas and the Centaur*, in the Uffizi. He came under the patronage of one of the Medici, for

whom when about 33 he painted his *Primavera* one of the loveliest pictures of the Italian Renaissance which shows Botticelli's work at its peak. The figures of *Flora* of *Venus* and of the *Three Graces* have the delicate slenderness characteristic of his work. The beauty of his design has been an inspiration to painters ever since.

From 1481 to 1484 Botticelli was in Rome employed by the Pope on work in the Sistine Chapel where he painted an *Adoration of the Magi* one of his favourite biblical subjects. Soon after his return to Florence came the circular picture of the *Madonna and Child* with surrounding saints and angels one of his best known works which now hangs in the Uffizi. The portrait of a young

man in the National Gallery London probably also dates from this period. About this time he began work on the *Birth of Venus* as renowned as his *Primavera* which is also in the Uffizi.



Botticelli

It is remarkable for its sensitive drawing and exquisite grace and has influenced the work of later artists as diverse as Burne Jones and Gauguin. During this period Botticelli produced a series of masterpieces including some of his finest Madonnas the Uffizi *Annunciation* and the *Mars and Venus* in the National Gallery. In the years following 1490 he produced a series of drawings illustrating the *Divina Commedia* of Dante the majority of which are now in Berlin. They have all the grace so characteristic of Botticelli and show understanding of the poet's religious intensity of feeling.

All his life Botticelli notwithstanding his fascination by the beauties of nature had himself a great measure of religious piety and mysticism and

towards the end of his life he became an avowed disciple of Savonarola. He produced few paintings after the end of the 15th cent. *A Nativity* and *Magdalene at the Foot of the Cross* were among his last pictures.

**Bottle** a vessel usually of glass having a constricted opening which can be closed.

In all glass blowing the first stage is the formation of what is called a parison. This is a mass of glass attached to the blow pipe having a hollow cavity and of such size that when air pressure is applied to the pipe the parison is expanded generally into a mould with the result that the desired object e.g. a bottle is produced. The simplest form of bottle-making machine is that known as the press and blow type. In this the parison is moulded by pressure from glass collected on a blow pipe and then transferred to a mould in which the bottle is blown. This system has the disadvantage that it is feasible only for the making of wide mouthed bottles and also that a considerable amount of hand labour is required. In what are called blow and blow machines the parison mould is filled with molten glass by suction from a tank and after the parison has been formed it is automatically transferred to a mould into which the bottle is blown. After moulding the bottles pass to the continuous annealing furnace termed a lehr.

The enormous demand for glass milk bottles has led to their manufacture by such machines on an enormous scale. The output of one machine may amount to as much as 50 gross in a working day of 9 hours though this is far exceeded by large machines for the production of small bottles which may produce as much as 1680 gross in a day.

There is considerable variety in the methods of closing the mouths of bottles. Apart from plastics such as pitch clay and wax the use of cork has been known from very early times and is very extensive even today though it is gradually being super-

seded by other methods. The most perfect method, and one of considerable antiquity, is the use of the ground glass stopper. This requires the neck of the bottle to be moulded to a fairly correct internal taper, while the stopper is prepared to have the same external taper. The stopper is then ground into the bottle by the use of emery powder and water. A very essential point is the perfect annealing of bottle and stopper, as otherwise the grinding, by breaking the surface of the glass, may cause a crack to develop.

Many forms of unground glass or earthenware stoppers combined with india-rubber rings are in use, the commonest being secured by a screw and a wire catch. The most recent development is the extensive use of caps pressed from bakelite and similar plastic materials, and with an internal thread, which fits a thread moulded externally on the neck of the bottle.

**Bottle-gourd**, the fruit of a plant of the cucumber family with a hard outer covering. On removal of the seeds and pulp, the case may be used as a flask.

**Bottle-nose**, see WHALES

**Bottomry Bond**, a contract made by the master of a ship for a loan of money to enable the ship to proceed on its voyage, the ship being security for repayment if it arrives safely at its destination.

**Botulism**, see CANNING, BOWELS

**Bouches du Rhône** [BŌŌSH DŌ RŌN], French department on the Mediterranean. Much of the W consists of the marshy district of the Camargue, the E and N are hilly and more fertile. Agriculture is fairly successful, the chief crops being cereals, grapes, olives, and early vegetables and fruit. Lignite, iron, stone, and clay are among its products. The great commercial port of Marseilles (*qv*) is the chief manufacturing centre, and general manufactures of the department include pottery, silk, paper, metal-founding, and oil. The coastal fisheries are valuable. There are Roman remains in various districts and a number of ancient churches.

Both the Rhône and Petit Rhône flow through the department; the chief towns are Marseilles, Arles, Arx, and Aubagne. Area, 2000 sq m, pop (1931) 1,102,000.

**Boucicault, Dion** (1822-1890), actor and dramatist best known for his *Colleen Bawn*, which was highly popular in England and America. His other plays include *The Corsican Brothers*, *Streets of London*, and *After Dark*. He first acted in his own play *The Vampire* (1852).

**Bougainville** [BŌŌGANVEL], Louis Antoine de (1729-1811), famous French navigator. He served with great distinction in the French Navy before the Revolution, and after it was honoured by Napoleon. He is best remembered for his voyage round the world (1766-69), of which he wrote a very fine account (1771).

**Bougainville** [BŌŌGANVEL], the largest island of the Solomon group, E of New Guinea. The Australians seized it from Germany in the World War, and the whole territory is jointly administered by Great Britain and Australia. Timber is the chief export. For general conditions see SOLOMON ISLANDS. Kieta, on the E coast, is the chief port and export centre of the group. Area, 3900 sq m, pop (1931) 30 500.

**Bougainvillea**, climbing shrubs for the warm greenhouse and high conservatories, highly decorative on account of the coloured bracts that almost cover the flowers. Mostly from S American tropical regions.

**Bought and Sold Notes**, notes exchanged between two merchants giving the terms of a contract of sale entered into between them.

**Boulanger, George Ernest Jean Marie** (1837-1891), French military commander and politician, fought in the Franco-Prussian War, and was given a command in 1880. Boulanger was Director of Infantry at the War Office (1882), commander of an expedition to Tunis (1884), and Minister of War (1886), for one year. In 1888 he was relieved of his army office for

insubordination entered politics and agitated for constitutional revision becoming the leader of the *Boulangist* movement which was pro-Catholic anti-German and reactionary. A charge of treason was laid against him and Boulanger fled to Jersey committing suicide in Brussels in 1891.

**Boulder Clay** the most typical of the deposits due to glaciation. It usually consists of boulders of varying composition generally angular in shape roughly smoothed and with fine scratches parallel to their length due to transportation by a moving ice sheet. These boulders are scattered in a haphazard manner in a matrix of clay which differs from true sedimentary clay in being unstratified and merely consisting of powdered largely unaltered rock. Some deposits are comparatively free from stones and have been alleged to represent the beds laid down by lakes dammed up by ice which have since disappeared. This type of boulder clay is found in the Lower Dee Valley in Cheshire and the Vale of Pickering in Yorkshire.

Boulder clay is found at different levels and generally forms broad flat plains but may be deposited in low ridges some hundreds of yards long with their long axis parallel to the direction in which the ice formerly moved. These ridges are called *drumlins* and good examples are to be seen in N Wales, Cumberland, S Scotland, Ireland and the Alps.

Boulder clay varies in composition largely owing to the kind of rocks underlying it. Red sandy clay covers red sandstone beds. The chalky boulder clay is a special white variety found over chalk deposits. The discovery of red chalk from Norfolk in a deposit of boulder clay at Highgate is a useful guide to the direction in which the ice travelled during the Glacial Period. The incorporated boulders or erratics (*q.v.*) furnish the same information for other areas. Boulder clay is found over Europe and America. In Sweden is a special kind called *varve-clay* finely laminated

with alternate layers of mud and silt due to seasonal changes in the rate of melting of the ice. Boulder clay is often termed *till* or *tillite* but these terms are usually restricted to hardened boulder clay.

**Boulle André Charles** (1642-1732) French cabinet maker who invented the decorative inlaying of furniture known as *Buhl* (*q.t.*). Boulle was employed at Court by Louis XIV and was responsible for the floors mirrored walls and much of the furniture at Versailles. His sons carried on his business after his death and his style was also copied by a host of imitators so that it is not easy to-day to distinguish his own work.

**Boulogne-sur-Mer** town and seaport of France on the English Channel. It has a good harbour and is an old town with cathedral, town hall and ramparts. As a health resort Boulogne is very popular. It is a cross Channel port with a regular service to Folkestone. Pop. (1931) 86,000.

**Boulogne Siege of** (Sept. 14, 1544) the English under Henry VIII after 2 months' siege captured the town from the French. It remained in the hands of the English till 1560 when it was restored.

**Bounds Beating** the custom still observed in some rural parishes of walking in procession round the parish boundaries on Ascension Day. The procession was headed by the priest, churchwarden and choirboys, the latter being beaten with sticks. A custom probably dating back to pagan times.

**Bounty Queen Anne's** *see* ANNATES.

**Bourbon**, a French family of 9th cent. origin taking its name from a large barony in central France. The first Bourbon king of France was HENRY IV (1589) the son of Antoine of Bourbon, king of Navarre, descendant of the sixth son of Louis IX, who married (c. 1330) a Bourbon heiress. The younger branch of the family, the Bourbons of Orléans, did not occupy the throne till LOUIS I PHILIPPE (reigned 1830-48) who was descended from a

brother of Louis XIV The elder branch of the family gained the throne of Spain after the War of the Spanish Succession, Philip V of Spain being a grandson of Louis XIV and an ancestor of ex-king Alfonso XIII (deposed 1931), in Naples the first Bourbon king was Charles III of Spain, who established his son Ferdinand as king (1759), Ferdinand was temporarily deposed by Napoleon, and eventually his great-grandson Francis II lost his possessions in the unification of Italy (1860) The Bourbon dukes of Parma, who had held the title since 1748, also lost their duchy to Italy in 1860

**Bourbon Island**, see RÉUNION

**Bourbonnais**, ancient French province, roughly coterminous with the modern department of Allier From it the Bourbon family, who were its lords in the 10th cent, derived their name Cap, Moulins

**Bourchier, Arthur** (1864-1927), English actor-manager He was educated at Eton and Oxford, where he founded the O U A D C His first professional appearance was in 1889 as Jacques, in *As You Like It*, later Shakespearian rôles included Shylock, Macbeth, and Falstaff He created the part of Barnsfather's "Old Bill." He managed the Strand Theatre from 1919 Bourchier married Violet Vanbrugh in 1894, and Kyrle Bellew in 1918

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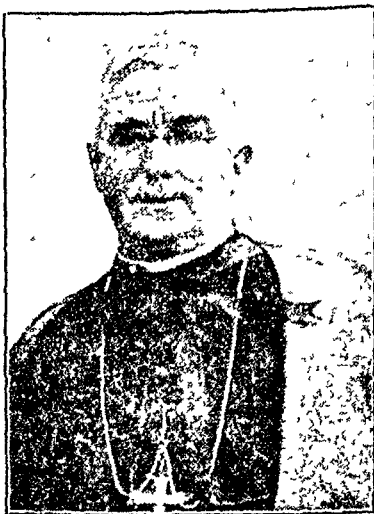
**Bourgeoisie**: originally a class of free citizens of a borough (Eng *burgess*), extended during the Industrial Revolution to comprise all between the aristocracy and the wage-earning workers The word is now used to denote the capitalist class, a distinc-

tion is sometimes made between the *grande bourgeoisie*, or industrial owners, and the *petite bourgeoisie*, or middle-classes

**Bourges**, former capital of Berry, France, situated at junction of the Rs Yèvre and Auron Its chief industry is engineering The cathedral, St Étienne, and the Palace of Jacques Cœur, now used as Law Courts, are its chief architectural features Pop 45,942

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Cardinal Bourne

Bournemouth seaside and health resort on the Hants coast. The equable climate and beautiful surroundings have made it peculiarly suited to invalids and its growth in this century has been very rapid. Care is taken to preserve the amenities of the district town planning is carefully developed. It has a well known art gallery and orchestra. Pop (1931) 116 780



Bou mo th the Pa lion

Bournville the model village near Birmingham erected for the employees of Cadbury's chocolate and cocoa works. Pop c 5000

Bourse, the name given to certain European stock exchanges

Boustrophedon [pron BOUS TRO FE DON] a term applied to certain ancient inscriptions in Greek Hittite and other languages signifying that the lines are written alternately from right to left and from left to right in the manner of a plough turning at each end of a furrow. The practice was historically intermediate between the Semitic right to left and the Greek left to right writing.

Bouts, Dierick (c 1400-1450) Dutch painter. Bouts work has a certain primitive stiffness of drawing but his pictures are highly expressive well-designed and rich in colour. Very little is known of his life but he was greatly influenced by the Van Eycks and by Roger van der Weyden under whom he may have studied. He lived in Louvain from about 1445 until his death. The only paintings known

definitely as his work are the altarpiece in the church of St Peter at Louvain consisting of a number of panels the central one representing the Last Supper and two paintings illustrating the life of Otto III which were executed for the Louvain town hall but are now in Brussels. A number of other paintings have been attributed to him including a *Pieta* and a *St Christopher* in the Louvre and an *Entombment* a *Virgin Enthroned* a *Madonna* and a *Portrait of a Man* in the National Gallery London.

Bouts Rimés [pron BÔUTR MĂ] (French rhymed ends) a literary amusement in which verses have to be fitted to previously given rhymes. It developed into a craze in France and England and at the beginning of the 10th cent societies were founded for its practice and public competitions were held at Bath.

Bowdler Thomas (1754-1830) edited Shakespeare and Gibbon's *Decline and Fall of the Roman Empire*. His careful omission of any expression or thought that seemed to him to be improper introduced into the language a new verb to bowdlerise.

Bowels Term applied to the lower portion of the alimentary canal usually referred to as the intestine (see DIGESTIVE SYSTEM).

Absorption of digested food takes place to a slight extent in the stomach and duodenum but most of it is carried out through the walls of the small intestine. Hence on arrival at the cæcum the greater part of the products of digestion have been absorbed and the food residue which remains enters the ascending part of the colon as a waste product. In the bowel food residue is further concentrated by the removal of water but in addition to this other things which are of further use to the body are also withdrawn. The bile for example which has been poured into the duodenum to help in the digestion of fats is reabsorbed into the blood and returned to the liver for use again.

The bowel has another function

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however, which operates in the reverse direction it excretes waste products from the blood into the lumen, and there, with the food residue, they are expelled from the body. In this respect, the bowel works in a manner which is very similar to the kidney.

The contents of the bowel are propelled along by the same muscular movements of the bowel walls as operate higher up, but when they reach the vicinity of the rectum, their movements are more periodic in occurrence. In fact, the whole mechanism of a healthy action of the bowels is dependent upon a nervous reflex which in some people is very easily thrown out of adjustment, and results in constipation—a complaint which we may define as a non-action of the bowels for a period exceeding 24 hours.

In addition to this nervous reflex there is another factor which influences this action and that is bulk. If the amount of food residue is too small, it may well fail to give rise to the desire for a normal movement. It may fairly be stated here that there are very many sufferers from chronic constipation who could overcome this inconvenience if they would drink more water, and practise clockwork regularity in their personal habits.

The bowels are laden with micro-organisms which are always present. Normally they do no harm. But when they are allowed to accumulate, they produce poisonous products which circulate in the body.

Diarrhœa may briefly be said to be due to the presence in the *feces* of an abnormally large amount of fluid. This fluid may be, and usually is, water, but sometimes it takes the form of fat. There are disorders in which there is disability to remove the fats of the food from the alimentary canal, arising either from faulty digestion of fats, or else from faulty absorption of fats. In either case the result is the same, namely, what is called a fatty diarrhœa.

The mechanism and exact causes of these fat disorders are not yet fully

understood, but some explanation of them is probably to be found in a disordered function of the liver.

Diarrhœa associated with water retention is, however, more fully understood, and its cause is usually to be found in some substance which acts as an irritant to the mucous lining of the intestine. This irritant may be of two kinds. Either it can take the form of a poisonous substance which has been ingested with the food, as for example, arsenic and the like, or it can take the form of toxic substances produced in food in the presence of putrefaction.

Whereas arsenic and other metals will produce an irritation of the gut *per se*, yet it should be fully understood that food which has become "high" or putrid is not in itself a cause of diarrhœa. The fact is that there are dangerous micro-organisms which sometimes reach food and produce food poisoning, but these are dependent for their development upon the co-existence of putrefaction. Hence the organism producing botulism may contaminate good food and be swallowed without any ill-effects. But if the organism contaminates "high" food, it will multiply and produce toxic substances which act as soon as the food is swallowed. The effects of these toxic substances in the case of botulism are diarrhœa and a rapidly spreading paralysis of all the muscles of the body, so that the patient, who remains conscious to the end, eventually dies because his respiratory muscles are paralysed and he is unable to breathe.

In all conditions of diarrhœa, water is lost from the tissues of the body, with the result that the patient becomes very thin and wasted. Thus, in all such disorders, much comfort can be obtained by drinking large quantities of water, lemonade, or milk. Very frequently, diarrhœa can be cured by a stiff purge, which clears the bowel of the organism producing the trouble.

Mention must be made of worms—so often an unsuspected cause of ill-

health. Further details will be found in the article *Worms* but it should be mentioned here that the bowel is a favourite habitat for many of these creatures which spend half their lives inside man and the other half inside some other animal. They gain entrance to the human bowel when they are present in unclean food. Some of them produce no symptoms so that we do not realise their presence. Others lead to anal irritation if not to anaemia and general ill health.

**Bower bird**, an Australian bird related to the *Birds of Paradise* taking its name from its habit of constructing on the ground tunnels or bowers made of twigs and grasses and ornamented with small shells or other bright objects.

**Bow fin**, a fresh water fish about 2 ft long found in the lakes and other fresh waters of N America. It has the habit of coming to the surface to fill its air bladder and can live a long time out of water. In the breeding season it makes a nest of rushes for its eggs.

**Bowling** see BLEACHING

**Bowles, William Lisle (1781-1850)** English poet is best known for his *Fourteen Sonnets* which caused a minor revolution in poetry. Bowles's return to Nature and simplicity had a great influence on Coleridge and the younger poets of the time.

**Bowls**, one of the very oldest of extant outdoor sports was played in England at least as early as the 13th cent. It was among the lewd games prohibited by law under Edward III as likely to entice men away from the butts. Bowling alleys were established in London in the 15th cent. usually as adjuncts to taverns but were generally held in disrepute.

The word bowls first occurs in a statute of 1511. Biased bowls were first used in the 16th cent. The game was legally permitted on private greens but bowling alleys were actually illegal till 1843. It seems to have become more respectable by the time Drake played his famous game on Plymouth Hoe but it was not till c 1850

that a revival in popularity took place in Scotland whence the game spread rapidly so that a standard code of laws was drawn up.

Efforts to organise the game were first made in Australia where the Bowling Associations of Victoria and N S W were formed in 1850. The Scottish Bowling Association was formed in 1897 and the English Bowling Association in 1903. In 1905 all existing Associations were amalgamated in the Imperial Bowling Association.

There are two types of bowling green the *level* and the *crow*. The latter which is confined to the N of England has a fall of about 18 in from the centre. It requires bowls of narrow bias and is less scientific than the normal game. There is no regulation size for a bowling green but a green 40 yds square is ideal. A green is divided into a number of rinks 18-21 ft wide.

**The Game** Each player uses four bowls made of lignum vitae in single-handed games two in matches. The bowls or woods are 4½-5½ in in diameter and weigh not more than 3½ lb. The bias was formerly obtained by loading with lead but now by making one side more convex than the other. The smallest bias must produce a draw of 8 ft in 30 yd on a perfect green. The *jack* is a white earthenware ball about 2½ in in diameter. The player delivers his wood with one foot on a mat 24 x 16 in in size the aim being to bring the bowl to rest nearer the jack than any of his opponents to protect a well placed bowl or dislodge an opponent's bowl. The game is played between teams or rinks of 4 a side a match term usually consisting of 4 rinks or 16 in all. A rink consists of a leader 2nd and 3rd players and a skip. The leader places the mat throws the jack delivers the first bowl and calls the result of each end to the skip who stands at the far end of the rink. The 2nd player marks the score on a card

and the 3rd player is responsible for measuring when necessary to decide which ball is nearer the jack. The "skip" plays last. When an "end" is concluded, the leader places the mat near the jack, which he then throws to the opposite end, and the game begins afresh.

The jack must be thrown not less than 25 yds and must be not less than 2 yds from any boundary of the rink. A jack driven off the rink becomes "dead," and the "end" is "void."

**Box**, an evergreen shrub which grows wild in Surrey, and is naturalised elsewhere. It is hardy, and resistant to the atmosphere of towns, and therefore much used for low hedges. It is frequently clipped into artificial shapes.

**Boxers**, a secret society in China, which at the instigation of the Empress-Dowager, led the anti-foreign rising in 1900 known as the Boxer Rising. See also FAR EAST, CHINA.

**Boxing**, the art of attack and defence with the fists, bare or encased in boxing-gloves, is first mentioned in the *Iliad* of Homer in connection with the funeral games of Patroclus. It formed a regular feature of the Olympian Games (see ATHLETIC SPORTS). The Greek boxers or pugilists ("fist-fighters") wore the *cestus*,



Vittorio Campolo

heavy strips of leather bound round the hand and wrist, to add force to the blow. Later, in the *pancratium*, boxing and wrestling were combined. Under the Roman Empire pugilism was a popular item in the public games. The boxers were mostly Greek professionals. In response to the degraded taste of the time they wore a *cestus* studded with

bone and metal. The fight between Dares and Entellus described by Vergil in the 5th book of the *Aeneid* is typical of a Roman boxing-match.

There is no further mention of pugilism until its revival as a typically English sport in the early 18th cent. The first recognised champion of England was James Figg (champion 1719-30), who, however, was not so much a



"Young" Stribling

boxer as an expert with quarter-staff, singlestick, and broadsword. John Broughton (champion 1734-70) drew up the *Prize-ring Rules*, which governed pugilism until 1806, when they were superseded by the Queensberry rules. Broughton is also credited with inventing boxing-gloves, then used in practice only, all matches under prize-ring rules being fought with the bare fists. The palmy days of the English prize-ring extended from about 1780 to 1820, when the names of Tom Cribb, Tom Spring, Jim Belcher, Daniel Mendoza, and "Gentleman" Jackson were household words, and the "young bloods" of the day, including Lord Byron, flocked to Jackson's rooms for instruction in the "noble art." According to prize-ring rules, wrestling and throwing were allowed, a "round" ended when one of the combatants fell, or was knocked down, and the fight continued until one of the combatants failed to "come up to scratch," to toe a mark in the centre of the ring.

Increasing brutality and corruption gradually brought the prize-ring into disrepute, and the last important fight with bare knuckles was between Tom

Sayers and the American J C Heenan in 1860. After this the laws against prize fighting were strictly enforced and the old style pugilism practically died out.



J. K. Starky

Modern boxing dates from 1866 when the Amateur Athletic Club was formed. This year too there was published the code of rules which bears the name of the Marquis of Queensberry and with modifications still regulates boxing. Under Queensberry Rules boxing gloves must be worn and contests take place in a ring from 12 to 24 ft square. Rounds are of 3 or 3 minutes duration with intervals of 1 or 1 minute. No wrestling or holding is allowed and when the fighters fall into a clinch they must break away when so ordered by the referee. A blow below the belt is a foul as also are blows with the open glove and side or back of the hand or with the shoulder or elbow. There is no official limit to the number of rounds in professional boxing but contests are seldom arranged for more than 15 rounds which is the minimum number for championship contests.

In 1867 Lord Queensberry presented cups for competition among amateur boxers at all recognised weights and the Lonsdale belts which are held if won three times were later presented by Lord Lonsdale to encourage professional boxing. Only white boxers of British nationality are eligible for these belts. The Amateur Boxing Association was formed in 1884 and has since controlled the Amateur Championship.

Professional boxing is controlled at present in Great Britain by the

British Boxing Board of Control. The recognised weights for both amateur and professional boxing are: Fly weight under 8 st; Bantam weight under 8 st 6 lb; Feather weight under 9 st; Light weight under 9 st 9 lb; Welter weight under 10 st 7 lb; Middle weight under 11 st 6 lb; Light heavy (Cruiser) weight under 1 st 7 lb; Heavy weight no maximum.

Boxing in the U.S.A. stimulated by the career of the formidable John L. Sullivan made great strides in the second half of the 19th century and American boxers figure prominently in the list of the heavy weight champions of the world since 1880.

The World's Champions in 1933 were as follows: Fly weight Jack Brown, England; Bantam Al Brown, U.S.A.; Feather Kid Chocolate, Cuba; Light weight Tony Canzoneri, U.S.A.; Welter Jack Fields, U.S.A.; Middle weight Mel Tilton, France; Light heavy Max Baer, U.S.A.

Heavy weight Primo Carnera, Italy.

Box making. The manufacture of containers of all kind from a great variety of materials is continually



M. Schim

expanding industry. The tendency of all retail trade being towards the sale of ready packed articles. Many of the types of paper and cardboard box used for packing purposes are made entirely by machinery but fancy boxes of the better class are made largely by hand. The paper maker is continually developing new and attractive papers which are available for manufacture.

**Boxwood**, a hard, close-grained wood from the box tree (*Buxus sempervirens*), used by engravers and turners. The name is also applied to the dogwood of America, the whitewood of the W Indies, and the yellowwood of the E Indies

**Boyar** (БО-ЯН), a Russian noble title from the earliest Middle Ages onward. Originally the boyars were chosen by personal merit to form the prince's *duma* or council. They became courtiers in the 12th cent and were changed into an hereditary aristocracy by Peter the Great.

**Boy Bishop**. In the Middle Ages it was the custom to elect a boy, generally a cathedral chorister, to act as Boy Bishop from Dec 6-28. He wore episcopal dress, and performed minor ceremonies. This practice was condemned by the Council of Basle, 1431.

**Boycott**, the refusal and inciting of others to refuse to have commercial or social dealings with some person. The word is derived from the name of Captain Charles Boycott, to whom such treatment was applied in Ireland in 1880. Such a combination of persons for the purpose of injuring another is an actionable wrong if the purpose is unlawful, *e.g.* injury, or if the means to carry out a lawful object, such as furtherance of one's own proper interests, are unlawful, *e.g.* intimidation and threats. But by the Trade Disputes Act, 1906, acts done in furtherance of a trade dispute by a Trade Union or some person are not actionable merely because they interfere with trade or employment, or result in breach of a contract of employment. By the Trade Unions Act, 1927, certain acts done in contemplation or furtherance of a strike or lock-out are declared illegal.

**Boyle, Robert** (1627-1691), English physicist, born at Lismore, Ireland. After settling at Oxford, he established a chemical laboratory, and became leader of a small scientific society. He invented the air-pump and established Boyle's Law (see GASES, PHYSICAL PROPERTIES or)

about 1660. A year later, in his work entitled *The Sceptical Chymist*, he overthrew the Aristotelean idea of four "elements," and gave the modern scientific definition of an element as a substance that cannot be analysed. He was the first to conduct chemical experiments with any degree of quantitative accuracy. To his credit may be placed the modern thermometer, the use of a colour indicator to demonstrate the presence of acid, freezing mixture, and the isolation of hydrogen and phosphorus.

**Boyle's Law**, see GASES, PHYSICAL PROPERTIES OF.

**Boyne**, Irish river flowing N.E. from Co. Kildare to the Irish Sea, just E. of Drogheda. It is c. 70 m. long, chief tributary, the Blackwater.

**Boyne, Battle of the** (the English Revolution) (July 1, 1690) the English under William III. defeated the Irish under James II. at a cost of 500, including Schomberg, against an Irish loss of 1500.

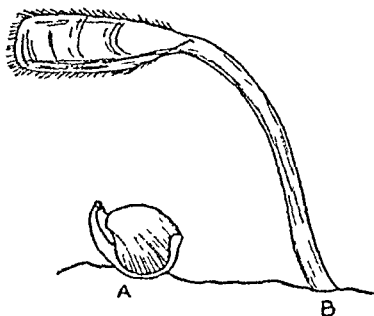
**Boys' Brigade**, an organised body of boys, founded in 1883, by Mr. (afterward Sir) William A. Smith, of Glasgow, to encourage "true Christian manliness." Each company, of which there are over 1300, is connected with a local church or other religious institution, and is given military, gymnastic, ambulance, and athletic training, as well as instruction in bible-study. The movement numbers c. 100,000. Headquarters, Abbey House, Westminster.

**Boy Scout**, member of a non-political, non-class and interdenominational movement founded in 1908 by Lord (then Sir R.) Baden-Powell, to inculcate in boys the principles of good citizenship. The Boy Scout pledge runs as follows: "I will do my duty to God and my country. I will do my best to help others, whatever it costs me. I know the scout law, and will obey it." The law mentioned is designed to instil the highest code of honour and self-reliance, and the daily "good turn" has now become a household word. Drill, signalling,



of ornament worn by the human race. In Egypt and Assyria and in the East they were largely used as the insignia of kings and of triumphant warriors. Bracelets are frequently mentioned in the Bible, and were common in a great variety of forms among the Greeks and Romans. The old German and Scandinavian bracelets were massive affairs of copper, more nearly resembling armour, since they sheathed the whole fore-arm. Recently bracelets have been produced in the newer plastic materials, as well as in glass and the more usual metals, such as gold and silver.

**Brachiopoda** [*pron* BRA-KI-O'-PO-DŪ], are a phylum of bivalve animals re-



**Brachiopoda**  
A *Rhynchonella* Calcareous form attached by ventral valve  
B *Lingula* Horny form attached by stalk

sembling externally the bivalve Mollusca (*qv*), but differing in the valves of the shell being always bilaterally symmetrical, never quite equal to one another in size, and situated above and below the animal, instead of on each side. Brachiopoda have neither feet nor gills, and breathe by means of two ciliated arms diverging from each side of the mouth, which also serve to wash food into the shell.

Brachiopoda are marine, and attach themselves to rocks or corals, etc., either by the surface of one of the valves, or by a pedicle or stalk. They are universal in distribution, and inhabit shallow and deep water. The sexes are separate, and the young takes

the form of a free-swimming larva. They are divided into two orders according to whether the shell is hinged or not. Some are called "lamp shells," from their likeness to an ancient Roman lamp.

Formerly, the group was of much greater importance, for over 2000 fossil species are known, whereas the living kinds number only about 100. *Lingula*, found on the coast of America and of the Philippines, is probably the oldest form alive to-day. It dates back to the Cambrian. Several other species of Brachiopoda date back to the Ordovician. Fossil Brachiopoda appear in abundance, as a rule, in limestone beds, indicating a preference for clear water, though they also occur in clay deposits. The Wenlock Limestone, the Carboniferous Limestone, and the Jurassic Oolites are rich in these forms, of which *Rhynchonella* and *Terebratula*, close relatives of which are still in existence, and *Spirifer*, almost confined to the Palæozoic epoch, are the best known.

**Bracken**, a fern common in woods, and on open land, having creeping underground stems, and erect fronds which are curled when young. Spores are borne in microscopic capsules at the edges of the leaflets or pinnae. Bracken is one of the few plants able to live in deep shade; when it grows in the open it overshadows and destroys all smaller plants.

**Bradbury, John Swanwick, 1st Baron** (b. 1872), British Treasury official, joint permanent Secretary to the Treasury (1913), British representative on the Reparations Commission (1919). Raised to the peerage (1925). Treasury notes when signed with his name used to be known as "Bradburys." See CURRENCY NOTES.

**Braddon, Mary Elizabeth** (1837-1915), novelist, published her best-known book, *Lady Audley's Secret*, in 1862. It immediately attained great popularity. She was the mother of W. B. Maxwell (*qv*).

**Bradford**, industrial town in W. Riding, Yorks, c. 10 m W of Leeds. It

has long been noted for woollens. With the industrial revolution Bradford's importance rapidly increased. New worsted weaving, silk metal foundry.



Bradford Cartwright Memorial Hall

coal mining industries sprang up and in these days Bradford is one of the greatest industrial centres of the N and the largest wool buying town in England. The original village existed before the Norman Conquest and the cathedral dates from the 10th cent. The first mill was built at the beginning of the 19th cent. The Cartwright Memorial Hall commemorates the inventor of the power loom. Pop (1931) 298 041.

Bradford-on Avon small Wiltshire town celebrated for its remarkable Saxon church and ancient tithe barn. The old bridge with a chapel built on it is also of interest. Bradford-on Avon was in earlier times one of the foremost woollen and clothing towns in the W but has now greatly declined in importance. Pop (1931) (with rural district) 5506.

Bradlaugh Charles (1833-1891) English radical politician became law clerk 1853 lecturer on free thought and legal controversialist MP for Northampton 1860 after a long dispute with the House of Commons over the taking of the oath he was finally allowed to take it as a matter of form in 1896.

Bradley Francis Herbert (1846-1916) English philosopher was a fellow of Merton College Oxford. His works include *Ethical Studies* (1861-1907).

*Appearance and Reality* (1893) *Essays on Truth* (1914) and the well known *Principles of Logic* (1883-1910).

Bradley Henry (1845-1907) English philologist and co-editor of the *New English Dictionary*. His publications include *The Making of English* (1904) an interesting history of the language.

Bradley James (1693-1760) English astronomer resigned his ecclesiastical posts on his election as a professor at Oxford. His first publication was the *Corrections and Tables* in 1714 in Halley's *Astronomical Tables* of 1713. In 1714 he was made Astronomer Royal and in 1748 received Copley's medal. His chief work was done on the aberration of light and the nutation of the earth's axis.

Bradman Donald George (b 1908) Australian cricketer. He first played in Test cricket against India in



Don Bradman.

1928-9. Visiting England in 1940 he secured the record aggregate for a Test match series of 94 runs and an average of 139.14 scoring 334 at Leeds.



254 at Lord's, 232 at the Oval, and 131 at Nottingham

**Bradshaw, George** (1801-1853), English printer, originator and publisher of the famous railway guides and time-tables, was first an engraver and map-printer. He started time-table publishing in 1839

**Bradshaw, Henry** (1831-1886), English antiquary and librarian at Cambridge. He was Dean of King's College (1857-65). His works include volumes on subjects of antiquarian interest. The Henry Bradshaw Society was founded in 1890, to edit ancient and rare liturgical texts

**Bradshaw, John** (1602-1659), English lawyer and judge, President of the court at the trial of Charles I. A strong Republican, Bradshaw was a prominent member of the Commonwealth, but disagreed with Cromwell and retired

**Brady, Nicholas** (1659-1726), English clergyman, Prebendary of Cork 1688. He supported the anti-Stuart revolution, and was therefore unpopular in Ireland. He came to London 1691, and obtained preferment there. He is best known for his collaboration with Nahum Tate in a metrical version of the Psalms

**Braemar**, district in S. Aberdeenshire, containing a number of castles and forest preserves, of which the most important are Balmoral and Aberfeldie (Royal), Braemar Castle, and Old Mar Lodge. The village of Braemar is famous for the Highland Games which take place near-by

**Brag**, a very old card game for 5, 6, or more players, with a full pack. Each player puts up 3 stakes and receives 3 cards, the last being dealt face upwards. The first stake is won by the holder of the highest card, irrespective of suit. For the second stake, players holding 2 or 3 cards of the same denomination (pair and pair-royal), bet or *brag* against each other. The knave of clubs is treated as a joker, and may be counted as any card. The third stake is won by the player whose cards total nearest to 31, count-

ing by pips, court cards counting 10. Each player may draw from "stock," losing if he overdraws, i.e. brings his total to more than 31

**Braga**, chief city in the district of the same name, forming part of the province of Minho e Douro in Portugal, the surrounding district is mountainous and pastoral. It is the seat of an archbishop. There are some hardware industries, especially cutlery. The rather flamboyant cathedral shows signs of Moorish influence. Area of the district, 1040 sq. m., pop. (1930) 399,300. Pop. of the city, c. 23,000

**Braga, Theophilo** (1843-1921), Portuguese statesman, deputy for Lisbon 1909, first provisional President of the Portuguese Republic (1910) till the election of Arriaga as constitutional President, he succeeded Arriaga in 1915, holding office until 1919. He published poems and philosophic writings

**Bragança** (or **Braganza**), a subdivision of the NE Portuguese province of Traz-os-Montes, watered by the R. Sabor, on which stands its capital, the cathedral city of Bragança. Agriculture and sericulture are the principal industries. The city of Bragança (pop. 6000) is divided into the upper town, an ancient walled settlement, and a modern lower town. In the 15th cent. an illegitimate son of the reigning Portuguese king became Duke of Bragança, his descendants ruled Portugal from 1640 until the revolution of 1910. In 1807, during the Napoleonic era, John VI was compelled to withdraw to Brazil. His son Peter became the first Emperor of Brazil in 1822, when that country declared its independence, and the Bragança dynasty ruled here until 1889. The ex-King Manoel of Portugal, the last of the European dynasty, died in England (1932). Area of district, 2513 sq. m., pop. (1930) 181,200

**Bragg, Sir Wm. Henry** (b. 1862), English scientist, Director of the Royal Institution and of the Davy-Faraday Research Laboratory (appointed 1923). After a distinguished mathematical

career at Cambridge Bragg went to Australia where he held positions in the University of Adelaide. Then at Leeds and London he gained fame for his work on X rays and radioactivity. For this (with his son Wm Laurence Bragg professor at Manchester) he received the Nobel Prize (1915). Since then he has been honoured by many universities in Great Britain, Europe and America. His publications include *Studies on Radioactivity Concerning the Nature of Things* and many articles in scientific journals.

**Brahe Tycho (1546-1601)** Danish astronomer patronised first by the King of Denmark and later by the Emperor. He fixed the positions of over 900 fixed stars and published a book on the comet of 1577 besides checking many astronomical theories and compiling a table of refractions. He died in Prague while still engaged in active work.

**Brahmana**, a commentary on each of the four Vedas, the sacred books of the Hindu religion describing the Hindu ritual and explaining its meaning.

**Brahmans**, the priestly and highest caste of Hindus until recent times almost the sole educated class of Indian society entrusted with the preservation and exposition of the Vedas (q.v.). See also HINDUISM.

**Brahmaputra**, great river of Tibet and India rising near the headwaters of the Indus. The glaciers of the N Himalayas are its principal source. It flows E for 1000 m in Tibet where it is known as the Tsang po. The middle part of the upper course is navigable for light craft. The river makes a remarkable bend round the E flank of the Himalayas before descending through gorges in a series of rapids to the valleys of Assam where its direction changes to W and SW and it becomes known as the Brahmaputra (i.e. Brahmas Son). Entering the Bengal lowland the river joins the Ganges at Goalundo. The drainage area covers over 360 000 sq m and the Indian section is navigable for

steamers from its confluence with the Ganges to Dibrugarh in Assam a distance of c 800 m. It is the main artery of communication between Bengal and Assam and an invaluable means of irrigation especially to the tea growing district of Assam. The lower stream is so broad that it is not bridged at any point and no large city exists on its banks comparable with those of the Ganges. Tributaries are numerous but of little individual importance. Length 1800 m.

See *The Fiddle of the Tsang po Gorges* by F. Kingdon Ward (1906).

**Brahms, Johannes (1833-1897)** the direct successor to Beethoven as a master of symphonic form. Born in Hamburg the son of a member of the Hamburg

Theatre or orchestra as a youth he aroused the admiration of Liszt and Joachim by his piano-playing, and in 1854 he was appointed Director of Music to the



Prince of Lippe Detmold with whom he remained 4 years. His chamber music and songs were already such as to move Schumann to hail him as the next great master. His D minor piano concerto given at a Leipzig concert in 1859 was none too cordially received but by 1863 he was sufficiently well regarded in academic circles to be offered the conductorship of the Vienna Singakademie. At the end of a year he ever he resigned and devoted his time to composing and occasional tours. For 3 years he was conductor of the Vienna Gesellschaft der Musikfreunde and continued to live in Vienna till his death.

The four symphonies with their superb architecture and noble melodies are masterpieces and though Brahms

was less happy as a composer for the piano, the finale of the B flat concerto proves that he could when he liked, write with grace and lightheartedness. The violin concerto is one of the greatest works ever written in that form, and his *Song of Destiny* is a remarkably beautiful piece of choral writing. His many songs would in themselves be sufficient justification for his inclusion among the great musicians. As the composer of the popular Hungarian dances, Brahms' name is known to many who are unfamiliar with his greater works.

**Braid**, a term originally meaning a plait, and frequently used of hair. Now used to describe a kind of tape, made of wool, silk, or cotton, and used for binding and trimming on clothing and furniture. Braid is often highly ornamental, with gold and silver threads.

**Braille** [*pron* brāl], the most widely used form of embossed lettering, enabling the blind to read by touch. It was invented by Louis Braille, a Frenchman (1809-1852), who became blind at the age of 3 years. The braille

A	B	C	D	E	F	G	H	I	J
••	••	••	••	••	••	••	••	••	••
••	••	••	••	••	••	••	••	••	••
K	L	M	N	O	P	Q	R	S	T
••	••	••	••	••	••	••	••	••	••
••	••	••	••	••	••	••	••	••	••
U	V	W	X	Y	Z	and	for	of	the
••	••	••	••	••	••	••	••	••	••
••	••	••	••	••	••	••	••	••	••
with	ch	gh	sh	th	wh	ed	er	ou	ow
••	••	••	••	••	••	••	••	••	••
••	••	••	••	••	••	••	••	••	••

Braille Alphabet

alphabet is made up of combinations of any number of dots up to six, the dots are, if all are used, as in the word "for," arranged two and two in three rows, one below the other. By means of a simple apparatus the blind can also write in the same style.

A remarkable invention made by C. E. Fournier d'Albe enables the blind to read ordinary print, it is called the Optophone (*q v*)

**Brain**, see NERVOUS SYSTEM

**Braising**, a mixture of two methods of food preparation, stewing and baking. The food is first fried, in order to develop the flavours, and then placed in a casserole (a braising pan is expensive and unnecessary), and cooked in a moderate oven.

*Foods suitable for Braising.*

Tough joints of meat

Tough game or poultry

Tough vegetables

*Rules for Preparation and Cooking.*

**Meat** Cut vegetables in large pieces, and fry in fat (a little fat bacon improves the flavour). Place the meat on top of the vegetables, cover with greased paper, and add sufficient water to cover. This bed of vegetables is called a *mirepoix*. Put on lid, and cook in moderate oven, until meat is tender, usually 1½-2 hours. The liquid may be made into a sauce.

The meat may be fried first, before the vegetables. The cooking on top of the stove is sometimes carried on for a longer period, about two-thirds of the whole time.

**Poultry** Prepare as above. A young pigeon will require 35-50 minutes, an old one 1-1½ hours.

**Vegetables** Braising is especially suitable for root vegetables, such as turnips, carrots, artichokes, etc. Green vegetables should be blanched first. The most suitable for braising are green peas and beans.

**Brakes** A brake is a device used to slow down or stop an object or a machine in motion, and the device in some form is probably as old as the wheel. The simplest type of brake consists of a shoe pressed upon the wheel tyre of a vehicle or machine. Another primitive form of vehicle brake is the drag, a hollow flat shoe which, when placed upon the ground and entered by the wheel, prevents further rotation of the latter. The simple form of vehicle brake first mentioned is still used almost exclusively on railways and tramways, but the means for operating it have

been greatly elaborated. Among the most valuable inventions of modern times were the Westinghouse air brake and the vacuum brake similar in fundamental principles. These brakes ensure automatic operation in case one part of a train becomes detached from the rest.

The principle of the Westinghouse brake is to operate the brakes on each carriage by means of pistons supplied with compressed air generated by a small compressor on the engine. On each carriage is a reservoir of compressed air the pressure of which applied to one side of the pistons connected with the brakes would cause them to be applied. Normally, however, this pressure is balanced by a pressure on the other side of the piston derived from a pipe line running along the whole train from a compressor on the engine. In case of a breakage of the train the pressure in the latter line is released whereupon the air pressure from the reservoirs in each coach automatically operates to put on the brakes which can also be operated by the driver or guard releasing the pressure. In the vacuum system the pipe line along the train is connected to a vacuum pump on the engine. This pipe line vacuum is applied on both sides of each piston on the coaches. When the line is broken or air admitted by the driver or guard one side of each piston is automatically sealed in its evacuated condition while the other side receives the full pressure of the atmosphere which puts on the brakes.

Motor-cars and other vehicles with pneumatic tyres are now generally supplied with brake drums which are hollow metal drums rigidly attached to the wheels and having their peripheries usually cylindrical co-axial with the wheel. The band brake applied to the outside of the drum in the form of a flexible metal band possessing generally a lining of friction material has been superseded by the more effective expanding type as used on most modern cars. This

consists of a pair of shoes each nearly semi-circular fitting inside the drum and pivoted so that a slight movement of their ends causes them to press upon the drum.

What is called servo mechanism is now frequently used on motor-cars to operate brake. The principle of this is the use of the operator's power merely to release other power (which may be supplied mechanically or also automatically or electrically) to effect the actual braking.

The most perfect brake is one which cannot lock the wheel for when a wheel is held still by the brake the frictional resistance to the motion of the vehicle is greatly decreased. Such a brake is possible in electric vehicles by re-connecting the motors in such a way as to cause them to generate current. The same is true of various type of hydraulic mechanism which are used to transmit power from the engine and really form slipping clutches capable of absorbing much energy but not of locking the wheel since they offer no resistance to motion at zero speed.

**Bramah** Ernest English author best known for his Chinese stories among which are *The Wallet of Kai Lung* (1900) and similar collections.

**Bramah** Joseph (1748-1814) English inventor was a cabinet maker until he patented his improvements on water-closets (1778). His best known inventions are the lock (1784) and the hydraulic press (1795) which are called after him and among others are a printing machine the bar engine and refinements on engines and boilers of several kinds. His press was based on Pascal's law a small force applied to a small area can be transmitted by fluid to a larger area where the force will be correspondingly increased. Bramah presses are still used for light handwork such as book binding.

**Bramante** Donato (1444-1514) Italian architect born at Urbino. He travelled throughout Italy studying ancient buildings and the remains of classical art. He designed churches in

various towns, and finally settled in Rome c 1500. Here he obtained the patronage of the Pope and built the *Cancellaria*. Julius II was so impressed by his talents that he put him in charge of the rebuilding of St Peter's, and he performed a part of this work before his death, including some of the vaulting. But his original designs were completely changed subsequently when Michelangelo was appointed architect.

**Bramble**, see BLACKBERRY

**Brambling**, see FRUCH

**Brampton, Henry Hawkins, Baron** (1817-1907), better known as Mr Justice Hawkins, English judge, born at Hitchin, Herts, and educated at Bedford School. He was called to the Bar in 1813, took silk in 1858, and was appointed a judge of the High Court of Justice in 1876. Highly reputed as a barrister, he was briefed in many of the leading cases in his time. As a criminal judge he acquired a reputation for sternness, and the nickname "The Hanging Judge", nevertheless persons wrongly accused preferred to be tried before him.

**Bran**, "the Blessed," a figure of Celtic legend, said to have sailed into the Atlantic Ocean and discovered *Hy Breasil*, the islands of the blest. His legend influenced that of St Brendan (q.v.).

**Brancker, Sir Sefton** (1877-1930), an important personality in English civil aviation. He was trained for the Army, served in the Boer War, and later for a number of years in India, during which time he made his first flight (1910). During the World War he held important administrative posts in the Royal Air Force, becoming a major-general in 1918, and receiving the K.C.B. in the following year. In 1922 he was made Director of Civil Aviation, and did very much to stimulate the work, making several long survey flights. He was killed in the disaster to the *Rrior* airship.

**Brandenburg** (1) Largest province of Prussia. A sandy plain, dotted with fertile districts, it was known as

"the Sandbox of the Holy Roman Empire." It is irrigated by the Elbe and Oder R's, and several hundred lakes. Products include limestone, cereals, flax, tobacco, fruit, and vegetables. Sheep-rearing is an important occupation and wool is exported. Industries are shipping, wool and cotton-weaving, spinning, paper-making, and brandy distilling. Area, 15,072 sq m, pop (without Berlin), 2,600,000.

**History** Originally inhabited by Slavs, Brandenburg was captured by Henry I in 923 and frequently changed hands as a result of Germany's varying political fortunes, Albert the Bear becoming first Margrave in 1134 and Frederick of Hohenzollern first Elector in 1417. Later, the province was associated with the rise of the Prussian State into a monarchy under Frederick William I in 1701.

(2) Capital town of the province of Brandenburg, on the Havel R. The old part of the town is on the right, and the new on the left, bank of the river, whilst the ancient castle and 11th-cent. cathedral stand on an islet. The industries are machinery, metal-work, tin-plate products, woollen and jute goods. Pop (1931) 60,900.

**Brandes, Georg** (1842-1927), Danish literary critic, became unpopular in Denmark on account of his scepticism, and in 1877 removed to Berlin. Here his reputation grew apace, and, in 1882 he was gladly welcomed back to Denmark, and given a pension. His best-known works were *Main Currents of 19th Century Literature*, a collection of lectures given from 1872 to 1875, *Danish Poets* (1877), and *A Study of Shakespeare*.

**Branding**, a form of marking animals or slaves by stamping with a hot iron, formerly a popular mode of punishing criminals. In England this method of punishment became obsolete in the 18th cent when branding with a cold iron took its place, and was abolished in 1829, except as regards deserters from the Army, for whom it remained a legal punishment until 1879.

**Brandt (or Brant) Sebastian** (1458-591) German poet author of *Das Narrenschiff* (1494) a widely popular and deeply influential satire which formed the basis of Alexander Barclay's *The Ship of Fools* (1509)

**Brandy** see SPIRITS

**Brandywine Creek** a stream in Pennsylvania and Delaware U.S.A. and the scene of a battle in the American War of Independence 1777 when a superior force of British under Lord Howe was defeated

**Brangwyn Frank** (b 1867) English painter A.R.A. 1904 R.A. 1910 He worked at first with William Morris but it was not until he travelled to the east that he developed the highly personal style which is a feature of all his work. His paintings are strong in drawing rich in colour and romantic in conception his groups of sailors and long-shore types are full of vigour The influences most visible are those of Velazquez and Murillo in their early periods

He painted decorative panels for the Royal Exchange and the Skinners' Company Hall in London and examples of his work hang in the Luxembourg and in other Continental galleries. His woodcuts and etchings are greatly admired He has also designed a series of posters for the British railway companies

**Brant, Sebastian,** see BRANDT SEBASTIAN

**Branting Karl Hjalmar** (1860-1930) Swedish statesman a distinguished student and a founder of the Swedish Labour Party (1889) He was Socialist deputy to the *Riksdag* (1896) Finance Minister (1917) Premier (1910 1913 and 1914-5) He advocated neutrality in the World War supported the League of Nations and gained the Nobel Peace prize (1911)

**Brantôme Pierre de Bourdeille Abbé de** (c 1540-1614) French historian of noble birth Though the holder of several ecclesiastical preferments he led a soldier's life taking part in several expeditions and in the wars of religion He was acquainted with Mary Queen

of Scots Queen Elizabeth and Filippo Strozzi He gives an account of his life and times in his revealing *Memoirs* which are valuable for their literary and psychological as well as historical interest Better known are his *Vies des Dames Illustres* and *Vies des Dames Galantes*

**Brass** is an alloy of copper and zinc In olden times it was often confused with bronze chiefly owing to the hazy distinction then made between zinc and tin

If the alloy contains more than 60 per cent of zinc the colour is whitish with a zinc content below that figure the colour is intermediate between that of copper and white The average brass of commerce contains 33 per cent of zinc but there are a large number of brasses of other compositions available Brass with 20 per cent of zinc is known as *Dutch metal* and is used in the manufacture of cheap ornaments owing to its golden colour

*Muntz metal* consists of a brass with 40 per cent zinc if 1 per cent of lead is added the metal becomes very ductile and can be drawn into wires. An extremely strong alloy is *mangaese brass* which is Muntz metal containing about 1 per cent each of tin and iron and deoxidised during casting by the addition of manganese

*Del metal* consists of 50 per cent of copper 41 per cent of zinc and 4 per cent of other metals such as iron and lead together with a trace of phosphorus It is extremely strong and has good resistance to corrosion. It is sometimes employed for the manufacture of ships' propellers See also ALLOYS ELECTRO-PLATING ELECTROTYPING.

**Brasses Monumental**, a form of memorial to the dead most widely used between the 13th and 17th cents The usual form was a brass plate laid in the floor of the church with a representation of the deceased together with the armorial bearings of his family and decorations. A variation was a life-size statue recumbent on a raised tomb of which a marvellous example is the

tomb of Charles the Bold in Bruges, which, besides having a portrait statue, showing the clothing in great detail, is ornamented with a surround of delicate wrought brass, so fine as to be almost lace-like

Fine examples are found in churches all over the country, especially in Sussex, Devon, Oxford, Norfolk, Shropshire, Warwick, and an extremely quaint example exists at E Sutton,

practice the usual colours employed are red and black

The historical value of monumental brasses is very great, as they represent very faithfully all the details of contemporary costume, weapons, and armour

**Brass-finishing, Colouring, and Polishing.** Brass castings, stampings, and other articles are generally dipped in a liquid containing strong nitric acid

## MONUMENTAL BRASSES



Monumental Brasses

- 1 Peter de Lacy, A.D. 1375 Northfleet Church, Kent
- 2 Knight and Lady of Stourton family, A.D. 1401 Sowtry Church, Huntingdonshire
- 3 Thos Rolfe, Sergeant at Law, A.D. 1439 Gosfield Church, Essex

Kent, where Sir Edward Filmer (d. 1629) and his wife are shown, together with their 18 children

Occasionally the engraved lines on the brass were filled with colour, and this practice has been increasingly followed since the revival of brasses in the 19th cent. The most common form now is the list of killed in the World War, found in churches and on war memorials. In present-day

which removes all oxide and dirt, and leaves the article with a clean surface. According to the composition of the liquid, the surface after dipping is bright or matt. The matt or dead dip consists of a mixture of equal volume of strong sulphuric acid (oil of vitriol) and nitric acid (aqua fortis) saturated with zinc sulphate. This is often made by adding c. 6 oz of metallic zinc to 1 gal of nitric acid, and when it,

dissolved slowly adding the sulphuric acid. These liquids are very dangerous and corrosive and great care is necessary in using them. *Bright dip* is made by adding lampblack and common salt to the mixed acid the proportion of the latter being about 1 part to 900. If a greater proportion of nitric acid is used the colour will be more golden. After dipping the articles must be thoroughly washed with water and dried by sawdust.

Brass is bronzed by methods mentioned under *Bronzing*. A black colour such as is used for high-class instruments is best obtained by the use of a solution of platinum chloride containing nitrate of tin. This is however very expensive and good results may be obtained by using a solution of carbonate of copper in strong ammonia as strong as it is possible to obtain. The brass must be perfectly clean and free from grease and is therefore boiled in caustic copper. Brass is best polished if a very high polish is desired by a rapidly rotating buff, no polishing powder or liquid will give results of equal brilliance. The art of lacquering brass in the manner used by instrument makers is a difficult one and it is being superseded by nickel and chromium plating. Colourless cellulose lacquers preserve brass from tarnishing and are very easily applied but are not very durable.

**Brassó** town ceded to Rumania in 1919 formerly part of Transylvania. The Protestant Gothic church is named the Black Church because of its smoke stained walls. Brassó is magnificently situated with the Burzen plain on one side and the Transylvanian Alps on the other. Pop. (1930) 58,341.

**Brătianu, Ion Constantin** (1871-1921) Rumanian Liberal statesman, deputy in provisional Government 1918, escaped to Paris when rising was quelled, returned 1921. Brătianu was Liberal leader and Premier from 1926 to 1928. His son Ion Brătianu (1894-1977) continued

a Liberal policy, was Premier during and after the World War and a delegate to the Peace Conference 1919.

**Bratislava** (Hung. *Felsőny* Ge. *Pressburg*) city and chief Danubian port of Czechoslovakia. Capital of Hungary from 1541 to 1784 many of the early Habsburg kings were crowned there. There is a Slovak university, a broadcasting station and a flourishing wine industry producing most of the Hungarian champagne. Pop. (1930) 133,477.

**Brawling** in law the offence of quarrelling or creating a disturbance in a church or churchyard punishable by a fine not exceeding £5 or imprisonment not exceeding two months.

**Bray** (*Dei Chualann*) watering place in Co. Wicklow Irish Free State a little S. of Dublin. It is a favourite resort for the inhabitants of Dublin. Pop. (1926) 8,600.

**Bray Vicar of**, Simon Aleya, parish priest of Bray in Berkshire is celebrated in the famous ballad. The Vicar of Bray. He retained his benefice during the reigns of Edward VI, Mary and Elizabeth by changing his religious opinions to suit those of his rulers. In the ballad he is represented as living in the time of the Stuarts.

**Brazil** (United States of Brazil) S. American Federal Republic occupying more than half the continent. It is larger in area than the U.S.A. Its Atlantic seaboard extends nearly 6000 m. and its frontiers touch those of every other S. American State save Chile. There are 27 States within the Republic the largest being Mato Grosso. The climate of this vast territory is varied and determined largely by altitude. In the centre is a great plateau averaging 2000 ft. in height to the N. thickly forested plains and to the E. and S. mountains and fertile valleys.

The waterways of Brazil which are of great commercial and industrial importance are extensive the Amazon, Paraná, Uruguay and Madeira being



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The waterways of Brazil which are of great commercial and industrial importance are extensive the Amazon, Paraná, Uruguay and Madeira being

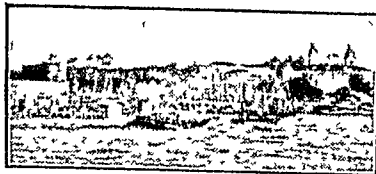
the more important. The drainage area of the Amazon and its tributaries extends over 3 million sq m. Small-draught vessels are able to explore 3600 m of the Amazon. There are also a few large lakes, and in the S the falls of Iguassu, flowing into the Upper Paraná, have a total fall of 320 ft, a source of energy supply for hydro-electric plants.

The flora of Brazil is rich. In the W and N vast quantities of rubber are available, the best and most productive areas being the States of Pará and Amazonas. Tropical fruits abound, and coffee is well distributed throughout São Paulo and Rio de Janeiro, Brazil having two-thirds of the world's coffee plants. The chief produce is maize, rice, sugar, wine, and bananas. These, with the wax-palm, cacao, Brazil nuts, and various cabinet woods like mahogany, rosewood, and ebony, provide a large annual revenue.

Brazil has a great variety of animal and reptile life. Almost one-sixth of all the birds in the world are found there, and fish are equally varied.

The mineral wealth of Brazil has not been developed, but coal is mined in Rio Grande do Sul, Santa Catharina, Paraná, and São Paulo, as well as manganese, iron, and gold in Minas Gêras.

Manufactures include cotton, silk, jute, paper, woollen goods, and to-

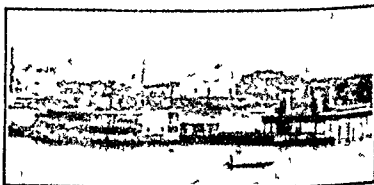


Brazil Manaoas

bacco. Brazil exports to the United Kingdom rubber, raw cotton, bananas, and oranges. Imports from the United Kingdom include coal, cotton-piece goods, machinery, and steel.

Road and rail communications are extensive, but of poor quality. In 1931 there were 22,270 miles of rail-

ways. The chief rail system is the Central Brazil, which links the country with Uruguay, Argentina, and Paraguay, but nothing has been done so far to connect by rail or water the Pacific and the Atlantic Oceans. The grandiose scheme, mooted in 1901, to construct a 10,000-m Pan-American rail-



Pará

way from New York to Buenos Aires has not materialised.

Education is free, but, except in 7 States, not compulsory. There is one official University at Rio de Janeiro, founded in 1920, two private universities, and nearly 60 faculties which are allowed to confer degrees, 7 engineering and mining seminaries, an Institute for experimental medicine in Rio, and the Butantan Institute for the preparation of "anti snake-bite serum". The language is Portuguese.

There is religious toleration, although Roman Catholics predominate. In 1889 Church and State were separated. Justice is administered by a Supreme Federal Court at Rio. Capital punishment is abolished, and there is no divorce.

In local government each State is administered under its own republican form of government, which must agree with the constitutional principle of the Union. The Constitution and Government of Brazil provides for a President of the Republic, who must be a Brazilian by birth. He is elected for a term of 4 years, and is not eligible for re-election. The Franchise decree of 1932 extended the vote to all citizens, male and female, over 21 years, except tramps, "illiterates," and soldiers on service. The Government is composed of 9 Departments, but the President is in supreme charge of the Army.

and Navy In the Chamber of Deputies there are 212 members and 63 members of the Senate which together form the National Congress.

The postal and telegraph system is developing every year there are 3 submarine cables connecting Brazil with Europe a mail and passenger air service with 66 (1931) planes available and 40 wireless stations.

The capital is Rio de Janeiro (pop. 1,488,611) other cities being Sao Paulo (879,784) Recife (340,743) and San Salvador (398,940).

It is said that in 1500 a Portuguese expedition bound for India went so far out of its course that it reached the Atlantic coast of South America and in some such manner Pedro Alvares Cabral discovered Brazil. There were wars for its possession between the Portuguese and Spanish but it was not until the Portuguese Royal family fled from Lisbon to Rio during the Napoleonic wars (1807) that Brazilian independence was within reach and not until 18 that it was accomplished and Dom Pedro the prince regent declared Emperor. In 1890 it became a republic and in 1930 political ferment led to a rising and a form of dictatorship which lasted until 1934. Area 3,250,000 sq. m. pop. (1931) estimated 41,477,800.

**Brazil Nut**, the fruit of a tall S. American tree (*Bertholletia excelsa*). The triangular-shaped nuts to the number of 18 to 24 are packed together in a hard capsule.

**Brazil Wood**, the red wood of a Brazilian tree (*Casalpinia echinata*) used in dyeing process. Also the Sapan Wood (*Casalpinia sappan*). An inferior wood is obtained from *Casalpinia batiliensis* and *C. cristata*.

**Brazing** one of the methods used from time immemorial to join metals together (see also **SOLDERING**) involving the use of a metal or alloy more fusible than the metals to be so joined. The latter are brought in as close contact as possible and the alloy melted so as to run between them. Brazing is done instead of soldering in cases

where a strong joint is required in the manufacture of bicycles. It is usually done on a hearth where is used as a flux and an alloy of copper and zinc known as spelter is employed in place of solder. The brazing of large joints is a highly skilled operation. See also **SOLDERING** and **WELDING**.

**Brazzaville** town in French Congo and capital of the Middle Congo Colony on Stanley Pool R. Congo. Headquarters of Governor General of French Equatorial Africa (pop. 60,000).

**Breach** in law an act or omission in violation of a right duty or obligation e.g. breach of contract breach of trust etc.

**Breach of the Peace** any offence against the peace of the realm. As soon as the central authority of the Crown was established in England its first endeavour was to ensure good order and every offence soon came to be recognised and understood as an offence against the king's peace. Until 1016 every indictment of a crime concluded with the words against the peace of our Lord the king his crown and dignity even though the crime might be forgivable or venial. See also **RIOT** **RIOR** **UNLAWFUL ASSEMBLY**.

**Bread** in the most general sense is any form of starchy food prepared for consumption by being made into a paste with water and heated to a sufficient temperature to cook the starch the result being a solid food which can be consumed as such. The art of leavening bread that is to say rendering it lighter and more palatable by allowing the dough to ferment before baking must be as old as the use of bread itself. Fermentation produces carbonic acid gas which dissolves in the water present and is evolved in the process of baking. Bread cannot be made from pure starch some sticky or glutinous substance must be present in order to produce the familiar consistency. In the case of wheat the gluten (qv) serves this purpose. This

is a nitrogenous substance similar in constitution to the proteins

Unleavened bread is also made and consumed on a very large scale to-day. The Jewish Passover cakes are made from plain flour, water, and salt, baked to a biscuit, Swedish rye bread, Scotch oatcake, and "cabin" and sea biscuits, known as "hard tack" by seafaring people, are all very similar in nature. They have the advantage of keeping, when properly preserved, for an indefinite period, and they are physiologically excellent food, because they require much mastication, the enzyme *ptyalin* of the saliva being necessary to the proper digestion of starch.

Dough may be raised both by the old fermentation method, and also by entrapping air, adding volatile substances to the dough, or adding substances which, when heated, yield gases.

These methods are well known in the domestic cooking of pastry and cake. Dough sufficiently beaten, especially when lard has been added to it, encloses a quantity of air which expands on cooking. The same is true of white of egg when beaten and added to the dough. *Baking-powders* (*qv*) develop gas when heated. They are of various compositions, e.g. 4 parts by weight of cream of tartar (acid potassium tartrate), 2 parts of sodium bicarbonate, and 2 parts of starch to keep the powder dry and prevent it acting too quickly. Acid calcium phosphate, acid sodium phosphate and alum are also all used in place of cream of tartar. None of these substances is likely to be injurious, except alum, the residue left in the bread is a mildly laxative salt.

*Fermented bread* is produced by three methods: (1) *leaven*, (2) *salt rising*, (3) *yeast*. *Leaven* really consists of a yeast culture, being simply dough from one batch which has been kept and used to infect the next batch of bread. In all modern industries, depending on fermentation by yeast, care is now taken to work with cultures of standard

composition, since "wild" yeasts are liable to produce uncertain and disagreeable flavours. Hence the use of *leaven* has practically been abandoned. *Salt rising* requires the use of mill, a mixture being made of salt, meal, baking soda, and boiling milk, and allowed to stand overnight. It is then mixed with the dough, and rising takes place by the action of special bacteria, which also have to be pure cultures. In bread made by *yeast*, the process commonly used by the baker, the flour, water, and yeast, together with such additions as milk, salt, malt, and lard, are mixed in a power-driven mixer to form a dough, which is then allowed to ferment at a carefully maintained temperature of c. 80° F. The dough is worked several times during fermentation in order to allow the gas produced to escape, since it would otherwise check the action of the yeast. The essence of successful baking is that the dough should be heated mainly by radiant heat. Bread is now almost invariably made by machinery, and the result is that great uniformity of product is possible.

Much, of course, depends upon the selection of the right variety of flour. Wheat flour itself varies greatly in its quality and properties according to its origin, and for the best bread requires to be blended. The bread in many parts of Europe has an admixture of rye, and pure rye bread, called *black bread* on account of its dark-brown colour, is still largely eaten in Holland, N. Germany, and E. Europe. Potato flour, although unsuitable for use by itself, is also largely used as an addition to bread. The white wheat flour commonly used in Great Britain and many other parts of the world for the standard grade of bread is produced by a process of milling which removes the whole of the bran and germ. The germ is exceedingly nutritious, containing a large percentage of nitrogenous food, while the bran has a stimulating effect on the digestive tract. Hence a number of brown and wholemeal wheat breads are made, and advocated

on hygienic grounds. It is probable that such bread is preferable to highly milled white bread provided that the digestion is not affected by it. Experience with prisoners of war showed that those accustomed to white bread may become seriously and even fatally ill if compelled to consume coarser bread especially wholemeal rye bread which is without injurious effect where it is normally consumed.

**Breadalbane** district in N.W. Perthshire situated between Atholl on the N. and Strathern on the S. Breadalbane consists of many peaks of the Grampians of which Ben Lawers (3981 ft) and Ben More (3943 ft) are the principal. The chief loch is Loch Tay and the rivers are the Orchy, Docharty, Lyon, Tochar, Almond and Upper Tay. Area 10<sup>00</sup> sq. m.

**Bread Fruit**, see **ARTOCARPUS**

**Breakspear Nicholas** see **ADRIAN (POPE)**

**Breakwater** see **HARBOUR**

**Bream**, a freshwater fish typically having the back arched and the belly compressed. In some lakes it may reach a weight of 10 lb.

**Breathing** see **RESPIRATORY SYSTEM**

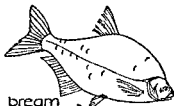
**Breccia**, term applied to rocks composed of angular fragments which have been broken from rocks already in existence and cemented together into a solid mass. They are named according to the particular agent of formation as fault breccia, volcanic breccia, etc. Sometimes the term may be restricted to volcanic breccias which are composed of coarse fragments ejected at volcanic eruptions.

**Brechin** royal burgh of Angus, Scotland. The chief industries are linen, rope and paper manufacture. There is a cathedral of the Church of Scotland and one of the few round towers in the country (dating from the 11th cent.). Brechin has many associations with Scotland's turbulent past. Pop. c. 600.

**Brecon** or *Brecknock*. Market town and capital of Breconshire, S. Wales. It is situated at the confluence of Honddu

and Usk Rivers. Of its buildings the Priory Church of St. John made the Cathedral of the newly-constituted diocese of Swansea and Brecon in 1933, and Christ College deserve mention. Pop. (1931) 5334.

**Breconshire** or *Brecknockshire* is a land county in S. Wales bounded by Radnor, Hereford, Monmouth, Glamorgan, Carmarthen and Cardigan. The surface is mountainous, the highest peak being Llan-y-Faw (Arthur's Chair) 910 ft. The chief rivers are the Usk and the Wye, whilst there are many lakes and springs. Traces of the



bream



Baltic bream

Roman occupation may still be seen notably the Y Gaer station 3 m. W. of Brecon. After the departure of the invaders it belonged to the Welsh princes until the 11th cent. The chief occupation is agriculture, horses, cattle and sheep are raised and the manufactures include woollen leather and iron goods. Coal is mined near Brynmawr whilst other minerals found are limestone and iron. Pop. (1931) 5771. Area 740 sq. m.

**Breda** town in N. Brabant, Netherlands situated at the junction of the Merk and Aa Rivers. Breda was granted municipal rights in 175 and until the 19th cent. was the most important fort along the Meuse. The Declaration of Breda by Charles II was made in 1660 and the Peace of Breda (between Holland, France and Denmark)

## Bréthigny

Dutch sect of mystics of the 14th cent., with whom Thomas à Kempis was associated. Their centre was the monastery of Groenendaal.

**Bréthigny, Peace of** (1360), between England and France, by which England renounced her claims to the French crown, Maine, Anjou, Normandy, and Touraine, and released King John, while France surrendered Gascony, Guienne, Poitou, Saintonge, Périgord, Limoges, Montreuil, Ponthieu, and Calais, and paid 3 million gold crowns.

**Breton, Cape**, see CAPE BRETON.

**Breton Language**, see CELTIC LANGUAGES.

**Breton Literature** is commonly classified as Old, Middle, and Modern. The Old Period (c 700–c 1000) is represented solely by various glosses and names. To the Middle Period (c 1000–c 1600) belong certain dictionaries and religious works in prose and verse, and three notable Mystery plays. The Modern Period consists mainly of mysteries and miracle plays, invariably acted by peasants. The chief wealth of Breton literature, however, is its ballads, folk-tales, and legends. F. M. Luzel collected many of these in his *Chants populaires de la Basse-Bretagne* (1868), and *Chansons populaires de la Basse-Bretagne* (1890) and *Veillées bretonnes, mœurs, chants, contes et récits populaires des Bretons-Armoricains* (1879).

**Breton, Nicholas** (1546?–1626), poet, is well known for his lyrics and pastorals. The former appeared in many anthologies, and some were included in *England's Helicon* (1600). Of his pastorals, *The Passionate Shepherd* (1604) is the best.

**Bretwalda**, the overlord of the Saxon Kingdom in the Heptarchy (q.v.).

**Breughel** [pron BRÖÖL], surname of a family of Flemish painters.

*Pieter Breughel, the Elder* (1525–1569), was born of peasant parents near Breda. He travelled to France and Italy, settling later at Antwerp and then at Bruges. His paintings are chiefly scenes of peasant life, humorous

in character, generally inferior to Teniers. His *Adoration of the Kings* is in the National Gallery.

*Pieter Breughel, the Younger* (1564–1637), son of the above. His *Christ bearing the Cross* hangs in the Museum at Antwerp, where his later life was spent. He was known as "Hell" Breughel, presumably through the gruesome nature of his subjects.

*Jan Breughel* (1568–1625), a younger brother, won considerable fame as a landscape painter, and assisted Rubens. He was styled "Velvet" Breughel, partly to distinguish him from his brother and partly from the material in which he generally chose to dress.

**Brevet**, a commission given to officers of and above captain's rank in the British Army, promoting them regardless of vacancies to be filled, as a reward for distinguished service. The system of bestowing general brevets on State and thanksgiving occasions was abolished in 1854.

**Breviary**, a collection of readings from the Holy Scriptures, psalms, hymns, prayers, etc., arranged in one from which Roman Catholic clergy recite the daily Divine Office, Hours (q.v.). It is usually divided into 4 parts, one for each season of the year. The present arrangement of the Breviary is due to Pope Pius V (1569). Certain changes were made in 1595 by Pope Pius X in order to prevent excessive repetition of certain psalms, offices, etc., and to simplify the arrangement of the office.

**Brevier**, see TYPES.

**Brewing**, see BEER AND BEVERAGES.

**ALCOHOLIC.**

**Brewster, Sir David** (1781–1868), Scottish physicist. One of the founders of the British Association for the Advancement of Science (1831), he did important work on the refraction and reflection of light, and persuaded British authorities to adopt the Fraunhofer apparatus in their light-houses.

**Brian Boróimhe** [BORÖÖ] (920–1014), King of Munster and of Ireland, succeeded his brother in Munster (945) and warred against Danes and ag-

# Briland

Dublin displaced the King of Ireland in 100... conquered most of the country and was recognised as the chief King. In 1013 he attacked the Danes at Dublin and defeated them in the great battle of Clontarf in the following year though he himself was slain.

Briland Aristide (186 -1932) French statesman many times Premier of France. Born in Nantes Briland embraced journalism and Socialism founded *L'Humanité* and was deputy (190 )



Aristide Briand.

he led movement for separation of Church and State broke a rail ay strike (1910) and was expelled from the Socialist Party. Premier for first time 1909-11. Briand was at different times between 1906 and 1932 Premier, Foreign Minister, Minister of Justice and Minister of Public Instruction and Worship. During the World War he was Premier and Foreign Minister 1915-17. After the peace he attended Washington Naval Conference (1919) negotiated the Locarno Pact (1925) was joint author of the Kellogg

Briland Pact of Paris (1919) for mutilated disarmament plans and proposed an international army and United States of Europe. He was one of the strongest supporters of the League of Nations.

Briland see ERICACRE.

Bribery the influencing of another by means of gifts payment of money etc. to do or to omit to do something in breach of his duty. Corruption of judicial and public officers voters etc. is a severely punishable offence. See also CORRUPT PRACTICES.

Bricks and Brick making. Bricks are artificial building blocks of small size the volume being determined by the weight which can be conveniently handled by the bricklayer with one hand. By far the most common material used for making bricks is clay (q.v.) but especially outside England other materials are used to a smaller extent. Clays are found in great variety and in most neighbourhoods and hence until recent times bricks were usually made very near to the buildings for whose construction they were to be used. In addition to clay it is often necessary to use as a component of the brick a sand or other material of a non plastic type. Grog (clay which has been heated) or waste from old bricks is also used.

The standard size of bricks is 8 in. x 4 in. in length 4 1/4 in. in breadth and 2 1/4 in. in thickness. The crushing strength of bricks in tons per sq. ft. varies very greatly. Mr A. B. Searle finds a variation from 5 to nearly 500. What are known as clinkers are the strongest bricks they are well vitrified. The Staffordshire blue bricks and other engineering bricks are also vitrified and are almost equally strong.

The first process in making plastic bricks is pugging the thorough mixing of clay and water to a paste of the right consistency. For this a pugmill is used consisting of a cylindrical vessel in which knives or beaters rotate round a central vertical axis. The most primitive



brick-making consists simply of moulding this plastic mass in a wooden frame by hand, to the size and shape of a brick. A simple form of hand-press which operates upon semi-dry material is now extensively used.

The next process necessary is drying if the bricks are very wet, they may need to be dried on a drying floor before stacking, but all bricks are finally stacked on what is called a "hack-ground," unless artificial drying plant is used. Too rapid drying is fatal, and hence both sun and rain must be kept away from the bricks as far as possible. Three to six weeks are required, and this fact, together with the necessary handling and damage, makes the process expensive.

There are two ways of burning hand-made bricks, in so-called "clamps" or in permanent kilns. A clamp is simply a suitably constructed pile of bricks which have fuel incorporated in their mass, together with further fuel by which the fire is started. When this is going, the fuel in the bricks themselves burns, and the whole mass acquires a sufficient temperature. Modern practice tends more and more to the use of a permanent ring-kiln, as described under FURNACES.

Hand moulding is by no means dead, but the next stage, that of plastic moulding by machinery into box-moulds, is largely superseding it, and a further stage, namely, the wire-cut brick, must now be considered. In this the material is made sufficiently plastic to be pressed out of a pugmill in the form of a continuous rod about  $9 \times 4\frac{1}{2}$  in in section, this is then cut into bricks by means of a wire or wires, just as cheese is cut for sale. The drawback to this method is that the material must be perfectly free from hard lumps, which would be dragged by the wire cutters with resulting disfigurement of the bricks. It is customary to operate the cutting process on "cutting tables," in which a number of wires cut simultaneously.

When accurate bricks are required, they are often re-pressed after drying.

In the stiff-plastic processes, the material is already much drier, and it is first formed roughly into what is called a "clot," which may be the shape of a brick, or may be cylindrical in section. This clot is then re-pressed into accurate shape before drying.

Drying is best effected artificially by heating the bricks to the temperature of boiling water in a closed space in which evaporation cannot occur, the bricks are then gradually exposed to dry air, with the result that the water rapidly evaporates without risk of their cracking. When kilns are used, the waste heat from the kilns is employed. In the semi-dry process the clay is only very slightly moistened, and the bricks are formed by means of powerful pressure. The bricks do not require drying, but are sent straight to the kiln.

To this category belongs the lime-sand brick, invented in England by Alexander in 1895, and very much used on the Continent. Such bricks consist of common sand or siliceous rock mixed with about 6-10 per cent of lime and a little water. They are formed by pressure, and then conveyed to a chamber, in which they are exposed to steam for 10 to 12, or sometimes 24 hours. The result is to cause a partial combination between the lime and the sand, with formation of calcium silicate, a process which occurs at ordinary temperatures in the course of centuries in ordinary mortar, which is a mixture of lime and sand. The resulting brick is not very strong mechanically, but is very resistant to atmospheric corrosion.

A short account of brickwork will be found in the article BUILDING. See also *Modern Brick-making*, by A. B. Searle (London, 1920).

Bridewell, part of old London between the Thames and Fleet Street. In the 16th cent a penitentiary for women of doubtful character was erected in the district, and the name has been applied to similar institutions in England and even in U.S.A. The name is derived from a near-by well dedicated to St. Bridget (St. Bride) in early times.

**Bridge**, a card game for 4 players developed from whist (qv) which it largely supplanted after about 1894 remaining the most popular of card games until itself superseded by auction bridge (qv) about 1907. Trumps are selected by the dealer or his partner without consultation. Dealer having first choice. Dealer's partner is dummy and lays his hand on the table after the first lead, the dealer playing both hands. The method of dealing and the play of the hand once trumps have been made is the same as in whist. Every trick made above 6 in *spades* scores 2, in *clubs* 4, *diamonds* 6, *hearts* 8, and in *no trumps* 12. Game is 30 points and rubber which add 100 to the score is the best of 3 games. *Honours* are scored as in auction bridge (qv) but *grand slam* counts only 40 and *little slam* 20. *chicane* (holding no trumps) scores twice the value of the trump suit. Only trick points count towards game.

**Bridge Sir Fredk** (1844-1914) English composer and organist at Westminster Abbey 1875-1918. Composed special music used for Queen Victoria's Jubilee and King Edward VII's coronation also other choral instrumental and organ music.

**Bridge of Dee** *Affair of the* (English Civil War) (June 18 1639) the Covenanters under Montrose forced a passage over the bridge of Dee and gained access to Aberdeen.

**Bridge of Sighs** *see* VENICE

**Bridgend** town of S Wales in Glamorganshire. It was formerly of considerable importance as a bridge town occupying both banks of the Ogwr and there are ruins of mediæval fortifications near by. Lime kilns, quarries and brickfields are the chief commercial undertakings. The town was formerly an active market and shows signs of reviving importance in this respect. Pop. increasing (1931) 10 030.

**Bridgeport** manufacturing city of Connecticut U.S.A. situated on Long Island Sound. There is a fine harbour and two parks. The most important

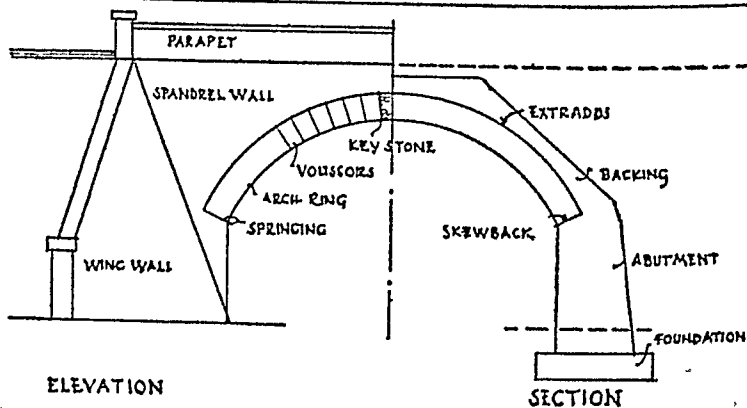
manufactures are fire arms, carriages, sewing machines and electrical machinery. Bridgeport supplied a considerable amount of fire arms and ammunition to the Allies during the World War. Pop. (1930) 146 000.

**Bridges** are structures erected to carry roads, railways, paths, tracks, canals or water pipes across rivers, channels, depressions in the ground or over other road, railways or tracks.

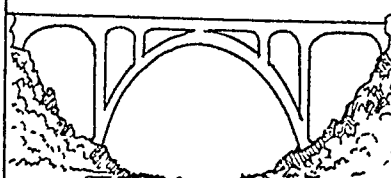
Bridges may be of one or more spans. In the case of a single span bridge the superstructure or traffic way rests at either end on supports termed abutments. In the case of a multi-span bridge the extreme end supports only are termed abutment, the intermediate supports being known as piers.

A bridge of many continuous spans is generally called a viaduct. Bridges according to their construction may be classified into three divisions: (1) girder bridges in which the superstructure rests freely on piers or abutments and transmits a vertical load only; (2) arch bridges in which the superstructure exerts a thrust on the abutments; (3) suspension bridges in which the traffic way is suspended from cables which pass over towers and are anchored back to the ground at each end. The classification is illustrated in the accompanying diagrams.

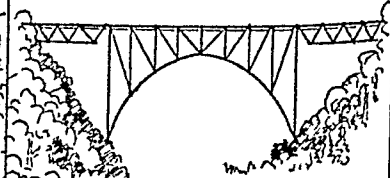
**Timber Bridges** Except in temporary work, bridges of timber are not used a great deal in modern practice. In pioneer railway work in America and the Colonies they were much used but on account of the danger from fire they are now practically all replaced by steel bridges. Timber bridges are generally of the girder type, the spans being made of triangulated trusses whose members are arranged in such a way that as many as possible shall be subject to a compressive rather than to a tensile stress. Where wooden members are in tension special attention must be paid to the joints in order that these may be at least as strong as any other part of the member. It is generally impossible to arrange for all members to be in compr



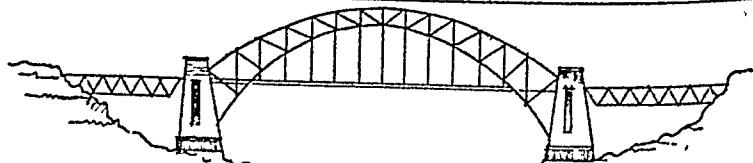
ELEVATION  
SECTION  
THE PARTS OF A SIMPLE BRICK OR MASONRY ARCH



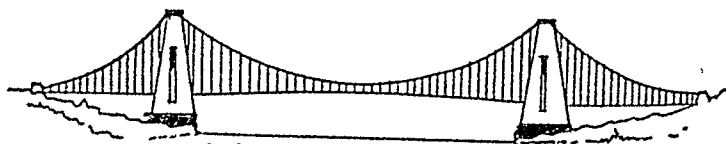
REINFORCED CONCRETE



THREE HINGED STEEL ARCH



STEEL ARCH WITH SUSPENDED TRAFFIC WAY



SUSPENSION BRIDGE

# BRIDGES

Underlying Principles of the Various Types

TOP CHORD [COMPRESSION]



BOTTOM CHORD [TENSION]

HOWE-TRUSS [TIMBER]



PRATT-TRUSS [STEEL]



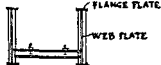
BOWSTRING GIRDER



WARREN-TRUSS



PLATE GIRDER



CROSS SECTION OF PLATE GIRDER



CANTILEVER BRIDGE

it is a usual practice to insert wrought-iron or steel bars for certain tension members. The most usual type of

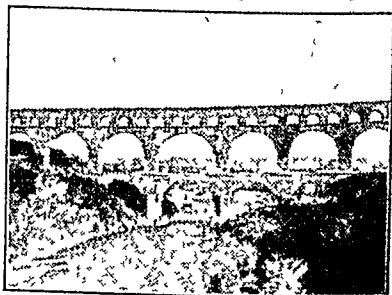


Suspension Bridge across the Colorado River, Grand Canyon, Arizona

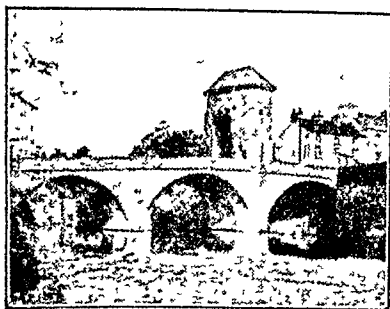
wooden girder or truss is the Howe truss. In railway work where gorges or canyons of considerable depth have to be crossed timber trusses supported on high trestles are used.

**Masonry Bridges** Bridges of stone and brick, owing to the fact that the units of construction are comparatively small and are incapable in mass of withstanding any tension, are of necessity always of the arch type. In an

exerts a lateral pressure on its neighbour. The thrust is thus eventually carried down to the abutment, or pier, where it is resisted either by ground pressure or by a corresponding but opposite thrust from another arch. The greater the load on the arch the more securely are the voussoirs wedged against each other, and failure will result from crushing of the stone or brick rather than from displacement of the units. In designing an arch ring it is usual to adopt wedge-shaped forms for the voussoirs, in order that the bearing surfaces may be at right angles to the line of pressure in the ring. So long as the pressure between two voussoirs is at right angles to the joint



Pont du Gard (between Avignon and Nîmes)



Monnow Bridge, Monmouth

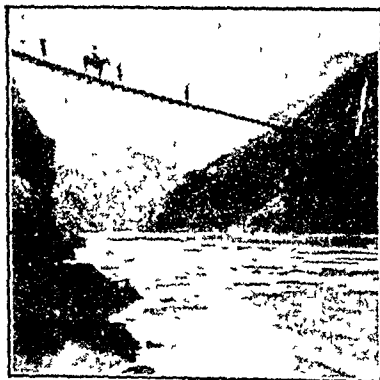
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contact surface, then the possibility of slipping is precluded. This explains the peculiar arrangement of the bricks seen in any railway skew-bridge. In a stone bridge the arch is sometimes formed of a number of ribs constructed of ashlar masonry, the spaces between the ribs being spanned by short members or by small arches. In brick arches the ring is generally of the same thickness throughout, the soffit presenting a smooth curved surface. Brick and masonry bridges must be constructed on timber centering made to the exact shape of the finished arch. The space above the arch ring is filled up with masonry, brickwork, or concrete to a certain height, and rubble or earth filling is then placed on top to bring the level to that required for the



BROADCASTING HOUSE, LONDON STUDIO FOR RELIGIOUS SERVICES  
(Architect for the interior: Edwin Lutyens, M.A. F.R.I.B.A.)

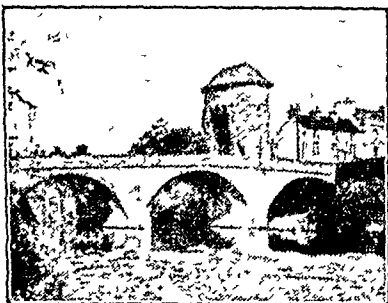
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Suspension Bridge across the Colorado River, Grand Canyon, Arizona

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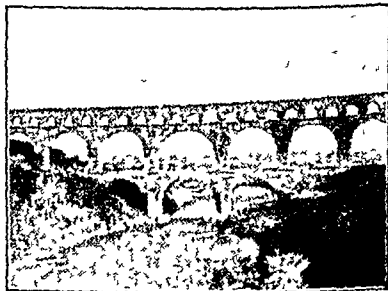
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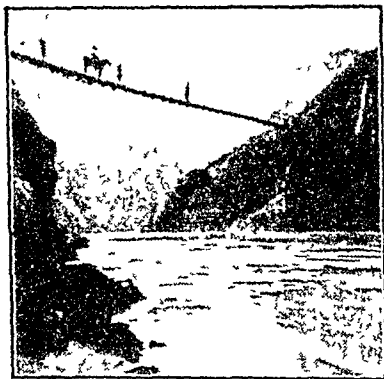
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 (Architects the interior Elton & M / M.A. FEIBA)



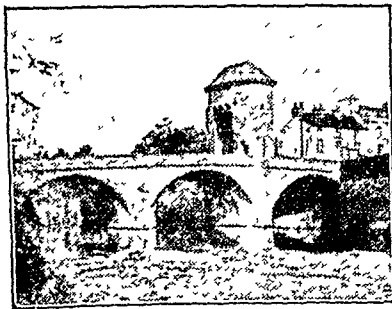
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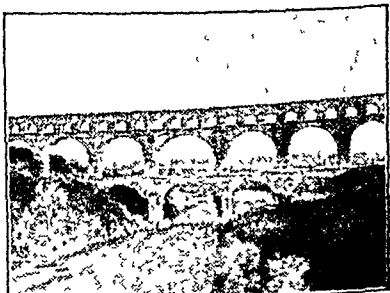
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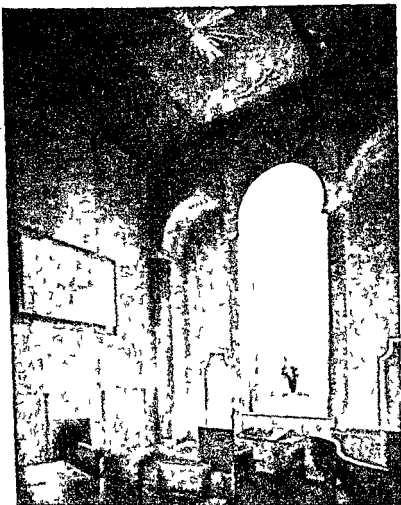
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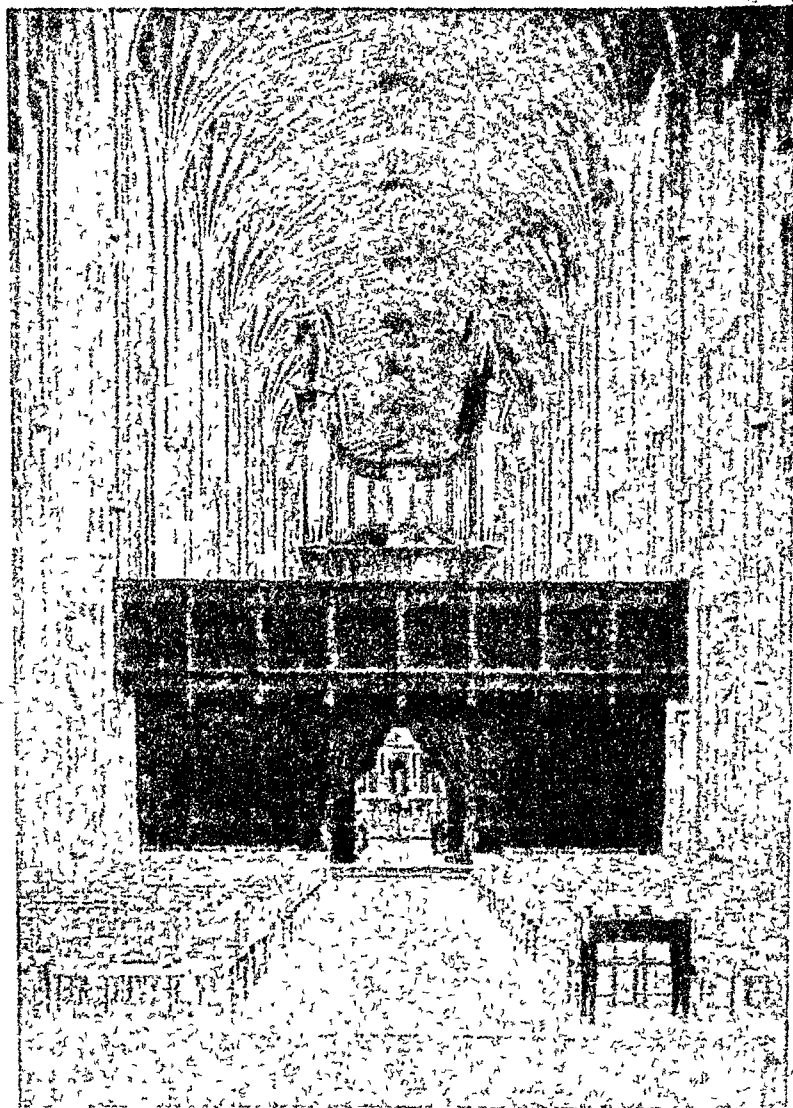


Pont du Gard (between Avignon and Nîmes)

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CAMBRIDGE KING'S COLLEGE CHAPEL. THE INTERIOR FROM THE WEST

road or railway formation. Such filling is retained on either side by span drel walls built up in brick or masonry flush with the outside face of the arch. The limiting span for a masonry arch is about 200 ft. The longest brick span 18 ft carries the G.W.R. main line over the Thames at Maidenhead.

**Steel Bridges.** Bridges of any of the three main types may be constructed in steel. The girder form is usually adopted for short spans, the arch or suspension form for very long spans. The commonest type of steel bridge is the plate girder, its use being confined to comparatively short spans such as road and railway crossings. Such a bridge consists of two girders side by side connected by short lateral members which form the decking and transmit the load to the main girders. The main girders are formed of vertical plates or webs which resist the shear stresses and of horizontal plates or flanges which resist the bending stresses. The decking usually consists of simple steel joists or a series of steel troughs riveted together. The whole structure rests upon the abutments, the girders being usually fixed at one end and free at the other to allow for expansion due to temperature or to loading.

For larger spans bridges of the truss type are employed. These trusses are really frames composed in such a way that the members are subjected to simple stresses, that is to simple tension or compression. The most usual form for moderate spans is the Pratt or D-girder. For large spans up to 600 ft trusses of the bowstring type and various elaborations of the Pratt truss are used. In large bridges of this kind account has to be taken not only of the stresses set up by the applied loads but also of those set up by wind, and to resist these stresses it is necessary to provide cross bracing between the two trusses forming the bridge. For spans over 600 ft the cantilever type, the arch type or the suspension type may be used. A cantilever is a bracket built out from

a support which is strong enough to resist the pull of the bracket. In bridge work it is usual to balance the pull of a cantilever bracket with that of another bracket in the opposite direction. It is then possible to build out each bracket for a considerable distance without intermediate support. The main span of a cantilever bridge is usually composed of two pairs of cantilever brackets connected by a short span supported on the end of each bracket. The most celebrated cantilever bridge in the world is the Forth Bridge with a total length of 5330 ft.

In suspension bridges the traffic way is suspended by vertical links from a chain or cable. This chain is supported on either bank by towers which are in



Forth Bridge      Edinburgh

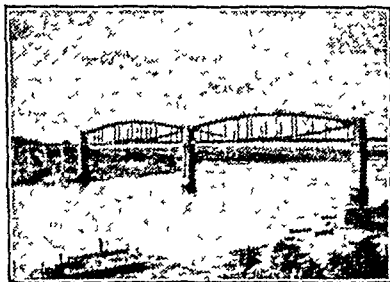
turn are hored to the ground by further chains. The greatest suspension bridges are to be found in New York, the Brooklyn Bridge having a centre span of 1575 ft.

Steel arch bridges are of two types, those in which the traffic way is tangential to the crown of the arch and is supported on vertical members rising from the arch, and those in which the traffic way is suspended from the arch by tie bars. Of the first type the Zambesi Bridge over the Victoria Falls with a span of 650 ft is a well known example, and of the second type a good illustration is provided by the Sydney Harbour Bridge. The clear span of the Sydney Bridge is 1600 ft. Steel arches are often hinged at the springings and sometimes at the crown as

the purpose being to allow the arch to alter its curvations in case of expansion due to temperature or loading

In steel bridges it is often necessary to provide an opening span to allow of the passage of ships. Such spans commonly take two forms. They may either be of the swing type consisting of a girder pivoted at its centre point and rotated by gearing, or of the bascule type consisting of a span pivoted at one end and capable of being rotated in a vertical plane. Bascule spans are usually balanced so as to be in equilibrium at an angle of  $45^\circ$  to the horizontal. A well-known example of a double-bascule is provided by the Tower Bridge, London.

Transporter bridges are used in



Saltash Bridge, Devon-Cornwall

special cases where banks of the waterway are not sufficiently high to permit of a high-level bridge, or where no hindrance to shipping must be caused. They consist of two towers, one on either bank, connected by a cable or girder which forms a track for a pulley or trolley suspending a cradle for containing the load.

Reinforced concrete is now being increasingly used for bridge constructions. Small bridges and culverts consist merely of a flat slab cast monolithic with the abutments. In medium span bridges two or more beams are used as the main spanning members, the intervening space being filled with transverse slabs. For still larger spans some form of arch is used, the arch being either hinged or monolithic.

An example of a three-hinged concrete arch may be seen in the Twickenham bridge. One factor alone retards the use of reinforced concrete for long-span bridge construction—the fact that elaborate centering has to be provided to support the arch during construction. Not only does this involve heavy expenditure, but it is often impracticable in the case of bridges over water-ways as it entails closing the river to traffic.

*Foundations for Bridges.* Whilst the foundations for bridges on dry land do not often present difficulties, those which are sited in river channels require special methods of construction. Two methods are in general use. If the depth is not great it is usual to construct a coffer-dam to exclude the water from the site of the foundation. If deep water foundations are involved a caisson is employed. The caisson in principle is a vertical steel cylinder closed at its upper end. It is sunk in position till it touches the river bottom and air is then pumped in at pressure to exclude all water. Men then proceed, through a special series of airlocks, to the main chamber and start excavating the river-bed. As excavation proceeds the caisson sinks by virtue of its own weight. When the required depth is reached all gear from inside the caisson is removed and the interior is filled up with mass concrete.

*See Modern Bridge Construction*, by Johnstone Taylor (Crosby Lockwood & Son).

**Bridges, Robert Seymour** (1844–1930), English poet, studied at St Bartholomew's Hospital, and was on the staffs of the Children's and the Great Northern hospitals. He retired in 1882, and devoted himself to writing. After producing literary criticism translations, and original poems, he was made Poet Laureate in 1913. His work is marked by artistry and craftsmanship and by his mastery of prosody, but it never approached the "popular" type of poetry. At 81, he published *The Testament of Beauty*, an epic of great philosophical interest.

His collected works including several plays have been published



Robert Bridges.

**Bridget, St.** (1) (c 45-52) (properly *Brigid*) Irish saint of Kildare about whom nothing is known except that she was a daughter of a prince of Ulster. She is also known as St. Bride and is one of Ireland's national patrons. Feast Feb 1. (2) (c 1300-1333) Swedish saint celebrated for her saintly and charitable life. Founded an Order of nuns called Bridgettines; she went to Rome in 1300 to obtain papal sanction for the Order and remained there until her death except for numerous pilgrimages.

**Bridgeton**, city in New Jersey, USA, situated S of Philadelphia. The chief manufactures are glass bottles, plate glass and jars, whilst fruit and vegetable canning is carried on. It is a rich agricultural region. Pop. (1971) 17,000.

**Bridgewater** title of a noble English family. The 1st Earl of Bridgewater John Egerton (1579-1649) a friend of Milton was the son of Sir Thomas Egerton Baron Ellesmere Viscount Brackley (1540-1614) Lord

Keeper (under Elizabeth) and Lord Chancellor (under James I). His great grandson Scroop was the first duke (created 1700). The 3rd (and last) Duke Francis Egerton (1730-1803) by his canals from Worsley to Manchester and between Manchester and Liverpool (1771) constructed by James Brindley (q.v.) founded inland navigation in England. The ownership of these waterways remained in the various branches of the family until 1897 when they were purchased by the Manchester Ship Canal Company. The 8th (and last) Earl of Bridgewater Francis Henry Egerton a famous bibliophile (d. 1879) left his library to the British Museum. To the Royal Society he bequeathed £8000 as payment to writers for a work on apologetics. Eight treatises called the Bridgewater Treatises were written by the authors including such men as Chalmers, Roget, Buckland and Prout.

**Bridgwater** seaport in Somerset, England, 17 m from the Bristol Channel E of the Quantock Hills on the R. Parret. Bridgwater which was the birthplace of Admiral Blake (1698) has canal communication with Taunton. Pop. (1931) 17,150.



Bridgwater. The H. B. B.

**Bridlington**, seaside resort in E Riding of Yorks. The town consists of two parts: the old market town lying 1 m inland, and the modern part on the bay. There are a number of fine old buildings, including the Priory Church and the town hall. Pop (1931) 19,701.

**Brie**, former district of France, including most of the department of Seine-et-Marne, with portions of the neighbouring departments. It is a famous corn-growing district, and manufactures a celebrated cheese. Area some 2350 sq m. Cap., Meaux.

**Brief**, a summary of the pleadings, proofs, and affidavits in any legal proceedings, together with a short statement of the facts of the plaintiff's or the defendant's case, which is handed to the barrister who is retained to conduct the case, and constitutes his authority to act for his client in all matters which the litigation involves. Counsel's fee is marked, and the result of the case is endorsed on the brief by the counsel and signed by the leading counsel on the opposing side.

**Brienzen Lake**, in the canton of Bern, Switzerland, 8½ m long, 1¼ m wide, with an area of 11½ sq m. Brienzen village, at N end of the lake, has earned a reputation for its magnificent wood-carvers, who have created a small industry.

**Brieux**, Eugène (b 1858), French dramatist. His plays are satires on definite evils of society, and deal with such subjects as divorce, legal hypocrisy, disease, etc. English translations exist of *Maternity*, *Damaged Goods*, and *The Three Daughters of M. Dupont*.

**Brig**, a two-masted vessel, square-rigged, originally propelled by additional oars. When the foremast only is square-rigged, and fore-and-aft sails are added, the vessel is termed a brigantine.

**Brigade**, army unit of two or more regiments under the command of a brigadier, or colonel. A British infantry brigade consists of 4 battalions with supply, transport, etc., attached, a cavalry brigade of 3 regiments and an

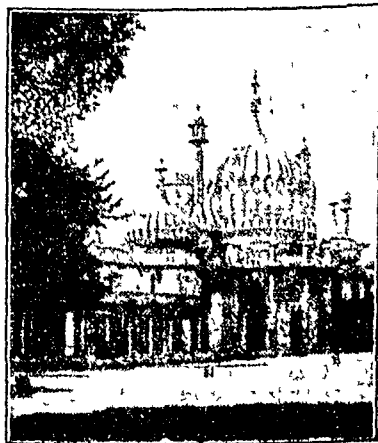
artillery brigade of 4 batteries. On the Continent, an infantry brigade consists of 2 regiments and 6 battalions.

**Brigadier**, formerly Brigadier-General, a military rank, originated by Louis XIV, and in the British Army equivalent to that of a major-general. In war-time a brigadier commands a brigade (qv). The rank was abolished between 1919 and 1928, and that of Colonel-Commandant substituted.

**Briggs**, Henry (1561-1630), English mathematician. He was made first Professor of Geometry at Gresham College in 1596. He is remembered especially for his work on logarithms, which he was the first to reduce to base 10. In 1617 and in 1624 he published logarithm tables and in 1631, his *Trigonometria Britannica*.

**Brighouse**, a town in W. Riding, Yorks, on the R. Calder. It is a centre of woollen and worsted manufacture, whilst iron-founding, soap-making, and chemical dye mixing are carried on. Flagstone quarries are also worked. Pop (1921) 20,300.

**Bright**, Sir Charles Tilston (1832-1888), English telegraph engineer. After superintending the laying of telegraph lines in many parts of Great



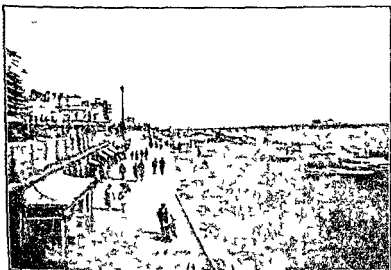
Brighton The Pavilion

Britain he organised the Atlantic Telegraph Company (1856) and as engineer-in-chief supervised the laying of the first Atlantic cable (1858). He subsequently laid submarine cables in various parts of the world.

Bright, John (1811-1889) British politician and orator. He at Lochdale joined Cobden in 1837 in agitation against the Corn Laws. Member for Durham 1843 contributed toward repeal of Corn Laws 1846. A Member

village but it became popular through the Prince of Wales's visit in 1841. As George IV he built the Pavilion as a residence but this is now used as a museum and art gallery. The famous Aquarium was rebuilt in 1899 as a pleasure resort comprising various houses of entertainment. The town is connected with London by electric railway. Pop. (1911) 14,400.

Bright's Disease disease of the kidneys and as it has been called under



Brighton. The Pier.

for Manchester Bright opposed the Crimean War and also Palmerston's policy in the Far East. Bright was a leading reformer from 1859-69. Privy Councillor and President of the Board of Trade under Gladstone 1868. Broke with Gladstone over Irish Home Rule Bill 1885-6.

Brighton popular watering place in Sussex, England 51 m. from London. The climate is mild and the magnificent promenade which is over 3 m. long overlooks the English Channel. In the 18th cent. Brighton was a fishing

the general term nephritis. Nephritis may be divided up into two main groups of kidney diseases: those due to infection and those not due to infection. Bright's disease is definitely an infection. Again the infective type of nephritis may be further subdivided into a nephritis which involves the whole kidney and one which involves only part. Bright's disease is of the former category for it involves the whole organ. Since the disease is infective and spreads from one part to another of the kidney structure until at last



has destroyed the function of the whole organ, it is fatal

It begins suddenly, as an acute feverish condition, and is always preceded by a chill or a sore throat. It is thought by some authorities that the sore throat is the primary cause of all the trouble. During this first stage, it is the glomerular part of the kidney which is inflamed and out of action (see KIDNEY). In consequence the kidney cannot excrete water from the blood, and the patient suffers, as a result, from a slight oedema or dropsy of the face, particularly marked by puffiness under the eyes. After several weeks, the condition seems to get better, but only too often it has gone a stage farther, into a latent or sub-acute form. In this second stage, the glomerular damage has healed up and normal function is restored. It is now the kidney tubules which are inflamed. The whole kidney becomes white and large, leading to generalised dropsy, which does not spare the intestine, so that diarrhoea and colitis may be prominent symptoms. The patient is also by this time suffering from a state of anæmia, and is consequently easily short of breath. In the third stage, the inflammation has spread back again to the glomerula without clearing up in the tubules, and the whole kidney, thus involved, begins to fail. The patient wakes in the morning with splitting headaches. His dropsy has improved, because he is losing fluid by drainage through the kidneys, but he is retaining waste products and toxins, for the kidney is failing to dispose of them. It is the accumulation of these wastes which may in the end send him into convulsions and unconsciousness, and finally death.

**Brill**, a marine European flat fish closely allied to the turbot (*q v*)

**Brillat-Savarin, Anthelme** (1755-1826), French writer on gastronomy, fled from the French revolution, but returned after Robespierre's death. His most famous book is his *Physiologie du Gout*, a standard work on the pleasures of the table

**Brimstone**, a popular name for sulphur (*q v*)

**Brindisi**, seaport on the Adriatic in southern Puglia, Italy. From earliest times it has been a port of departure for the East. It has an excellent harbour, well sheltered, and able to accommodate vessels of heavy draught. Pop (1931) 39,650

**Brindley, James** (1710-1772), English engineer, supervised the construction of the Worsley and Manchester Canals. With Telford and Macadam, Watt and Stephenson, Brindley stands as one of the pioneers of inland communication and one of the forerunners of the Industrial Revolution.

**Brine**, a naturally occurring solution of sodium chloride (common salt) contaminated with other salts, such as sodium carbonate, etc. The term, however, is frequently used to mean artificial solutions of sodium chloride used for refrigerating purposes, and it is applied also to other refrigerating solutions, such as those of calcium chloride, which contain no sodium chloride at all.

**Brine-shrimps** are lowly organised Crustacea (*q v*) of the group Branchiopoda. They have a long, many-jointed body, but no carapace, and the antennæ of the males are modified as claspers. Brine-shrimps live in water so saturated with salt that few animals can withstand it, and were formerly abundant in the salt pans at Lymington. Many different kinds are known, most being merely varieties dependent on the salinity of the water.

**Brinvilliers, Marie Madeleine, Marquise de** (c 1630-1676), French murderess, married the Marquis de Brinvilliers in 1651 and 8 years afterwards became the mistress of a cavalry officer, who was thrown into the Bastille on account of the scandal. In revenge, on his release, the officer instructed the Marquise in the use of poisons, with which she murdered, first her father (1666), then (1670) her two brothers. Suspicion fell on the Marquise, but she escaped to Belgium,

where she was captured. She was beheaded in Paris.

**Brisbane** *see* Explosives

**Brisbane** capital of the State of Queensland in the Australian Commonwealth. It is situated on the Brisbane R. c. 2½ m from its mouth in Moreton Bay and is the rail centre for the widely dispersed districts of the State. The river is navigable for deep draught vessels as far as the city and a busy trade is carried on chiefly in products of the pastoral regions to the W and in sugar. Chief articles of export are wool, tallow, hides, frozen meat and dairy produce. Local industries are developing and employ about a tenth of the urban population; they are chiefly the manufacture of clothing and foodstuffs and motor and engineering parts. *Brisbane* founded as a penal settlement in 1842 became a recognised urban centre in 1842 and with the constitution of the colony of Queensland in 1859 was selected as the capital. The climate is sub-

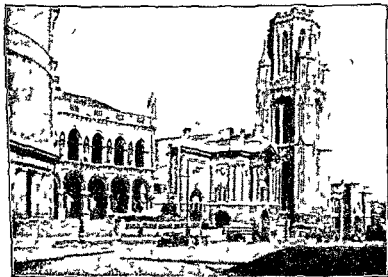
tropical and enervating but Brisbane is spaciouly planned in hilly country and is very attractive. The



L. van

University of Queensland was opened there in 1911. Pop. (1931) estimated with suburbs 97,000.

**Bristol** city and port of England in Gloucestershire and Somersetshire at junction of R. T. G. and A. on and 118 m W of London. Principal industries are tobacco and chocolate.



Bristol Art Gallery and University

manufacture, sugar refining, confectionery, potteries, brewing, chemicals, etc. Bristol carries on a large trade with the U.S.A., Canada, W. Indies, and elsewhere and exports coal, cotton, wood, salt, chemical products, machinery, hardware etc. Imports include fruit, grain, tobacco, oils, sugar, cattle and hides. In addition to the cathedral the city possesses a remarkable collection of churches, including that of St. Mary Redcliffe. The public buildings include



Bristol St. Peter's Hospital

the fine Council house, the City free library, claimed to be the first of its kind in England, an Art Gallery presented by Sir W. H. Wills in 1905, the Guildhall and Exchange. Educational establishments include Bristol University (1909), Clifton College (1862), the technical college of the Merchant Venturers Company (1885), and Colston's Girls' School (1891). Pop (1931) 400,000.

**Bristol, Earls and Marquesses of:** JOHN DIGBY, 1st Earl (1580-1653), an ambassador of James I, quarrelled with Charles I, who imprisoned him in

the Tower. He later supported the King against Parliament, and was exiled during the Civil War. His son, GEORGE, 2nd Earl (1612-1677), also supported Charles I, was secretary to Charles II 1657, but lost office by becoming a Roman Catholic. JOHN HERVEY (1665-1731) was 1st Earl of a new creation (1714), his descendant is the present and 8th Earl (4th marquess) FREDERICK WILLIAM HERVEY (b. 1863). He was a rear-admiral in the Navy, and M.P. in 1906.

**Bristol Channel**, arm of the Atlantic Ocean, extending from the mouth of the R. Severn to St. George's Channel, and separating S. Wales from the S.W. counties of England. Fishing is extensively carried on.

**Bristol Porcelain.** A factory for the making of porcelain was opened in 1770 as an extension of the business of William Cookworthy and Richard Champion at Bristol. The period of production was short, covering only 1773-81, and even in this short time the productions after 1778 were not equal to those of the previous 5 years. Vases, groups, biscuit plaques, and services were produced, of which the famous Burke Service, produced in 1774, is a fine example. This factory turned out the best English hand paste, which is noteworthy for its exceedingly lustrous glaze. Oriental and European designs were copied extensively, even to their marks.

**Brisure**, *see* CADENCY.

**Britain**, the English version of the Roman *Britannia*, the Latin name for all or part of the British Isles; the name seems to have been loosely used, and may be the Latinised form of the Celtic name for the main island.

**Britannia Metal**, an alloy consisting mainly of tin and antimony which is employed for the manufacture of table-ware (*see* ANTIMONY).

**Britannicus** (c. A.D. 41-55), son of the Emperor Claudius, poisoned by Nero, whom Claudius had been persuaded to adopt as successor.

**British Association**, a scientific society founded in 1831 for the ad-

vancement of science. A conference is held every year either in an English city or in one of the Dominions. The Association is concerned not only with pure science but also with its economic aspects. This society hears papers on mathematics, economics, physics, zoology etc. and also provides funds for research work.

**British Central Africa**, old name for British possessions in Central Africa corresponding to the modern territories of N Rhodesia and Nyasaland. The central districts of E Africa were not comprehended in the term.

**British Columbia** most W province of the Dominion of Canada bounded E by the Rocky Mountains and longitude 120° W and on the W by Alaska and the Pacific Ocean. The USA bounds it in the S and the N boundary is latitude 60° N. Area 372 000 sq m. pop (1931) 689 000.

The resources of the province are varied and considerable. Gold attracted the first great influx of population but it is now superseded by lead, copper, coal, zinc and silver. In that order. Gold originally worked as an alluvial deposit is now mined as ore chiefly in the Kootenay, Rossland and Boundary districts. Coal is of great potential importance and widely distributed; it is now worked only on Vancouver Island and in the Rockies. The coastal districts are an important source of metallurgical ores. Lumber and allied products and agriculture are of even greater value than mining. Fruit growing is highly specialised. The fisheries, both sea and fresh water (cod, herring, halibut and salmon) are very valuable and whaling is fairly profitable. Fish canning is growing in importance. Enormous water power in the many streams has led to great hydro-electric developments.

The population has more than trebled since 1900, the bulk of the newcomers being whites, but the immigration of Chinese and Japanese has been considerable, especially since the World War. The Chinese proved

very unpopular and were barred by legislation in 1933. There are c. 20 000 American Indians living chiefly in their reservations. The largest town is Vancouver (300 000) on the mainland but Victoria (60 000) on Vancouver Island is the capital. Other towns are New Westminster (18 000) and Nanaimo (10 000). About 53 0 m of railway are in use. Shipping is active. The telephonic communications of the province are more highly developed than in any other part of Canada.

The coast of British Columbia is fringed with islands of which Vancouver Island and the Queen Charlotte group are the largest. The interior is mountainous with deep valleys roughly parallel to the coast. The ranges often rise more than 10 000 ft. Mount Robson (13 068 ft) is the highest. The lower slopes are heavily forested. Principal rivers are the Fraser, Kootenay, Columbia and Skeena. They are of little value for navigation but are well stocked with fish. The upper courses of the Yukon and Peace R. are also within the province. The coasts of British Columbia within the temperate zone and exposed to the W winds have a climate more like England's than any other part of the Empire. In the mountainous hinterland conditions are more extreme with severe winter cold in the N. Rainfall is low in the S central regions and the summers are hot. Forests flourish in most parts of the province but the S is rather arid.

British Columbia was first sighted by the Spaniards in 1774. Captain James Cook explored the coasts 1781 and his work was amplified by Vancouver 1791-4. In the early part of the 19th cent. fur traders of the North West Company entered from the E. The Hudson's Bay Company ruled the district from 1811 to 1858 when it became a colony. Vancouver Island constituted a colony in 1849, was amalgamated with British Columbia in 1866 and the colony became a province of the Dominion in 1871. The earliest

discovery of mineral wealth was made in 1858, up to which time the inhabitants were chiefly fur traders and trappers. See also CANADA, DOMINION OF.

**British East Africa**, the former name of the area now known as Kenya Colony and Protectorate. Geographically the name may be stretched to include Kenya, Tanganyika, Uganda, and Zanzibar.

**British Empire**, general term for the aggregation of territories which own allegiance to the British Crown. It occupies about one-quarter of the land-surface of the globe, and is distributed unevenly over all five continents, including the whole of Australia, but a relatively minute portion of Europe. Lying largely within the temperate zones, it is divided almost equally between the N and S hemispheres, though the division between E and W is more uneven, approximately two-thirds of its territory occupying the E hemisphere. The total area is about 11,488,000 sq m. The total population is estimated at 470 millions, in the proportion of 70 million whites (of whom two-thirds are in the British Isles) and 400 million natives. By far the largest number of natives belong to India (350 millions), of the remainder there are some 35 million African negroes, 6 million Arabs, and a million each of Chinese and Polynesians, as well as 100,000 "Red Indians" in Canada.

**Religion**. Of the total population only 80 million are Christians, of these 67 million are Protestants and 13 million Roman Catholics. There are 250 million Hindus, half that number of Moslems, 13 million Buddhists, and 750,000 Jews.

**Constitution**. The British Empire is often spoken of as a "Commonwealth of Nations," or even as a "League of Nations." In some respects this is true, but the structure of the empire is too diversified for such a designation to be universally applicable. The expression, "Commonwealth of Nations," dates from the Irish Treaty in 1921.

The following classification may be recognised.

1 *The United Kingdom of Great Britain and Northern Ireland*, comprising England, Wales, Scotland and Northern Ireland, and all the British islands, except the Isle of Man and the Channel Islands, which occupy a somewhat anomalous position, in that they have independent legislatures and executives, but are subject to the control of the British Parliament. The islands belonging to the Irish Free State are not strictly British islands, and are, of course, administered by the Irish Free State. Northern Ireland, though part of the United Kingdom, is distinguished from the other members in having a form of Home Rule.

2 *The Self-governing Dominions*. These are the Dominion of Canada, the Dominion of New Zealand, the Commonwealth of Australia, the Union of S Africa, the Irish Free State, and the Dominion of Newfoundland. Together with the mother country they comprise the British Commonwealth of Nations. Subject to certain naval and military, legislative, and judicial restrictions, they may be regarded as independent nations, freely associated together in a league whose head is the British Crown. They are all represented in the Imperial Conference (see below), and therefore possess dominion status. All except Newfoundland are members of the League of Nations. Their independence has further international recognition in the fact that some of them appoint their own accredited Ministers to foreign capitals.

3 *Self-governing Colonies*—Malta and S Rhodesia. These two colonies have responsible government, but are subject to certain restrictions. They do not possess dominion status.

4 *India*. British India is administered, subject to the control of the Secretary of State for India, by the Governor-General in Council. The Native States, though largely auto-

mous are subject to the control of the Supreme Government of India. By the Government of India Act of 1919 the constitutional system described as diarchy was introduced with the object of gradually achieving responsible government. In 1933 further legislation was introduced with a view to hastening the attainment of that end. India is a member of the Imperial Conference and of the League of Nations and thus enjoys dominion status without complete self government.

**5 Crown Colonies** These are members of the British Empire whose executive is controlled by the British Government acting through the Secretary of State for the Colonies. Some colonies e.g. Barbados, Bermuda and British Guiana have wholly or partly elected legislative assemblies; others such as Ceylon and Fiji are administered by a Governor assisted by a State Council; in others again e.g. St. Helena the Governor alone constitutes the legislature. It is worth observing here that two of the dominions, Australia and New Zealand, have dependencies of their own administered as Crown colonies.

**6 Protectorates** are often candidates for colonial status and are usually administered on colonial lines. Their foreign relations are controlled by the Crown but they are not annexed to the Crown and their inhabitants are not British subjects. In most cases a protectorate is declared over more or less uncivilised tribes and is often a prelude to annexation. A notable exception is Egypt which became a British protectorate in 1914 and an independent state in 1922. See also PROTECTORATE.

**7 Mandat & Territories** are a legacy of the World War. They are administered by various members of the British Empire but do not form part of the empire. In one case, Iraq, the mandate has been surrendered and the territory in question has become an independent nation with member

ship of the League of Nations. See also MANDATE.

**8 Spheres of Influence** are areas not annexed to the British Empire in which British influence is acknowledged to be paramount e.g. parts of Arabia and the Persian Gulf. See also SPHERE OF INFLUENCE.

**9 Condominiums** are territories administered jointly with another Power. These are Anglo-Egyptian Sudan (with Egypt) and the New Hebrides (with France). See also CONDOMINIUM.

It is necessary to touch on one of two aspects of the interrelationship of the Dominions which are linked to Great Britain by ties so palpable that a foreign observer might regard them as non-existent though their deep reality was fully proved in 1914.

**The Imperial Conference** The British Commonwealth of Nations is in no sense a confederation though some of its members e.g. Australia are heads of local confederations. The germ of imperial co-operation took root in 1897 when the various colonial Prime Ministers present at Queen Victoria's Jubilee took the opportunity to discuss certain matters affecting the empire. Other colonial conferences followed. In 1907 the title of the conference of that year was changed to imperial and it was decided to meet at regular intervals (at first every 4 years). In 1911 the Dominion Premiers were initiated into the secrets of foreign policy though they were not allowed to share its responsibility. As at present constituted the members of the Imperial Conference are the Prime Ministers of the Dominions and the Secretary of State for India. Membership of the Conference confers dominion status.

**Self support** Great Britain lost the American colonies in 1776 by attempting to impose taxation without representation. Since then she has learnt the lesson of the American revolt, and now the Dominions manage their own financial affairs. There is nothing in the way of federal taxation for the

support of the empire as a whole. If the constitution of the Imperial Conference develops into a kind of federal assembly, the day may come when the Dominions will obtain representation without taxation.

*Defence* Questions affecting the safety of the empire as a whole are dealt with by the Imperial Defence Committee, whose aim is to co-ordinate the sea, land, and air arms. While each Dominion possesses military and air forces capable of great expansion in an emergency, as was seen in the World War, the naval defence of the empire is very largely dependent on the British navy. But even here the idea of complete self-defence is more than a mere potentiality, since both Canada and Australia possess small navies of their own.

*Legislation* In theory the British Parliament is the supreme legislative authority of the empire. In practice this has been delegated to the Parliaments of the various dominions, subject to the proviso that local legislation repugnant to the laws of the British Parliament is void. No dominion may declare war on its own authority.

*Judicature* The supreme judicial authority of the empire is the Judicial Committee of the Privy Council, which (since 1895) includes representatives of the Dominions and of India.

*Education* Nearly all the Dominions have universities and university colleges. A feature of the educational life of the empire is the opportunity given by the Rhodes Scholarships (*qv*) to overseas students, enabling them to become familiar with some aspects of life in the home country. A natural corollary is the idea of interchange of students, not yet fully developed.

*Capital of the Empire* The capital of the British Empire is London. As, however, all the Dominions are equal members with Great Britain of the British Commonwealth of Nations, it is not impossible that at some future time the centre of the empire may

be removed. In 100 years' time the population of Canada, for example, may exceed that of Great Britain, and one of its cities may become the imperial focus. The geographical position of London, however, situated as it is in the centre of the empire, will—coupled with sentiment—doubtless ensure to it for many years to come the place it now holds.

*Final Destiny* The Dominions are so free that it seems but a step to complete independence. Whether the glamour of freedom will ever supersede the enlightened self-interest that holds the British Empire together, is a matter for future politicians and historians.

*Growth of the British Empire.* The annexed Table I is intended to provide, in statistical form, a compendious survey, by continents, of the members of the British Empire. Further details will, of course, be found in the various articles on the countries, dominions, colonies, and protectorates concerned.

It will be seen from Table I that, apart from the Channel Islands, which were part of the property of William the Conqueror as Duke of Normandy, the whole of the British Empire as it exists to-day was won in the last 350 years, and a large proportion since 1800. It will also be noticed that the great dominions and India, distributed as they are over four of the five continents, are separated by very long distances both from each other and from the British Isles. The necessity for intercommunication has led to the annexation of various islands and other strong points along the ocean routes to be used as coaling and telegraph stations.

Another point of interest is that the Dominions, as such, are a very recent creation. It was not till 1867 that the principal Canadian provinces formed themselves into the Dominion of Canada. The other relevant dates are New Zealand 1870, Australia 1900, S. Africa 1909, and the Irish Free State 1922.

## I BRITISH EMPIRE

[Capital Londn]

Note—Cl 1 = Mother Country  
Class 2 = Dominion.Class 3 = Self-governing C I  
Class 4 = India.Class 5 = Crown Colony  
Cl 6 = Protectorate

Description	Cl	Date acq or ceded or established	How acq or established	Area (sq m)	Estimated pop	Remarks
Great Britain	1	—	—	88 750	44 700 000	—
Northern Ireland	1	1800	Govt of Ireland Act 1782	8 360	1 250 000	1. Same Rule.
Irish Free State	2	1922	—	26 600	2 200 000	1. Dominion added by Henry II in 1171.
Channel Island	1	1066	Inheritance	70	90 000	—
Isle of Man	1	1066	Purchase	20	40 000	—
Malta	2	1800	Conquest	120	34 000	—
Gibraltar	2	1704	do.	2	17 400	—
Antigua	2	1681	Acquisition	42 750	2 700 000	1. Area included in Labrida Coast 10 500 sq m total pop 41 000
Canada	2	1607	Settlement	3 600 000	10 200 000	2. Possession confirmed 1713 First Dominion.
Nova Scotia	Pro of 2	1628	Settlement	21 400	512 000	Ceded to France 1632 re-annexed 1713 Original base of Dominion of Canada
NW Territories	do.	1669	Settlement	1 300 000	9 700	Settled by Hudson Bay Co
Prince Edward Island	do.	1758-63	Conquest	2 000	88 000	—
Ontario	Pro of 2	1793-63	Conquest	412 000	3 431 000	—
Quebec	do.	1759-63	do.	694 400	2 874 500	—
NS Brunswick	do.	1763	Settlement	28 100	4 800	Original base of Dominion of Canada
Saskatchewan	do.	1774	do.	251 000	921 800	—
Manitoba	do.	1790	do.	50 300	21 000	—
British Columbia	do.	1811	do.	81 000	700 100	—
Yukon	do.	1811	do.	305 800	604 300	—
Western Indies	do.	1498	do.	907 100	4 500	—
Bahamas	2	1603	Settlement	105	17 000	—
Bermuda	2	1609	do.	20	27 800	—
Leeward Islands	2	1623-1761	do.	10	120 400	—
Bahamas	2	1623	do.	4 400	80 000	—
Jamaica	2	1655	Conquest	4 450	1 090 000	—
Lucia and Calicos	—	1658	Settlement	170	8 600	—
Trinidad	—	—	do.	100	8 200	—
Cayman Island	—	—	do.	510	107 300	—
Windward Islands	—	—	do.	—	—	—



<i>Description</i>	<i>Class</i>	<i>Date acquired, originated, or constituted</i>	<i>How acquired or originated</i>	<i>Area (sq m)</i>	<i>Estimated pop</i>	<i>Remarks</i>
Trinidad and Tobago	5	1763-97	do	1,980	411,600	Tobago reconquered from the French, 1803
CENTRAL AND S AMERICA Falkland Islands	5	1765	Settled	6,600	2,100	Area includes S Georgia, but not Antarctic Dependencies (c 3,100,000 sq m)
British Honduras	5	1798	Conquest	8,600	51,400	—
British Guiana	5	1803	do	89,500	310,900	—
ASIA. Indian Empire	4	From 1639	Cession and conquest	1,805,000 (provs 1,091,300)	353,000,000 (provs 270,561,400)	Transferred from E India Co to Imperial Government, 1858 Queen Victoria, Empress of India, 1877.
Madras	Pres of 4	1639-1748	Treaty and conquest	142,300	46,740,100	Capital Madras grew up round Fort St George, the first possession of E India Co French, 1746-8
Bombay	do	1661-85	Cession and annexation	123,600	21,870,100	Bombay Island part of dowry of Catherine of Braganza; made over by Charles II to E India Co in 1668
Bengal	do	1633-75	Cession and conquest	76,800	50,114,000	Separated from Madras, 1681
United Provinces of Agra and Oudh	Prov of 4	1764-1856	do	106,300	48,408,800	Title dates from 1902 Agra separated from Bengal, 1835, Oudh annexed, 1856
Central Provinces and Berar	do	1802-18	do	99,900	15,507,700	Province formed 1861 out of parts of Madras and N.W. Provinces (now United Provinces)
Ajmer-Merwara	do	1818	do	2,700	560,300	—
Coorg	do	1831	do	1,580	163,300	—
Assam	do	1826-40	do	53,000	8,622,300	Detached from Bengal, 1874, part of new province E. Bengal and Assam, 1905, again separated, 1912
Burma	do	1826-85	do	233,700	14,667,200	Question of separation from India being considered
Punjab	do	1849	Annexation	99,900	23,580,900	—
NW Frontier Province	do	1901	Transfer	13,400	2,425,100	Formed by transfer of part of Punjab
British Baluchistan	do	1888	Treaty and cession	54,200	463,500	—
Bihar and Orissa	do	1912	Transfer	83,200	37,677,600	Formed by transfer of part of Bengal
Delhi	do	1912	do	590	636,200	Territory of capital of India.
Andamans and Nicobars	do	1658-69	Annexation	3,100	29,500	Islands in Bay of Bengal
Aden and Perim	do	1839-57	do	80	48,000	Province since 1932, when separated from Bombay
Other Asiatic Possessions						
Ceylon	5	1795	Conquest	25,300	5,306,900	—
Straits Settlements	5	1786-1907	Conquest and cession	1,600	1,114,000	Dutch, 1818-21; under E. India Co, 1824-56, transferred from India, 1867

Description.	Class	Date acquired, or granted or constituted.	How acquired or original	Area (sq. m.)	Estimated population	Remarks.
Federated Malay States	6	1844-98	Treaty	27 600	1 713 100	—
Unfederated Malay States	6	1909	do.	22 400	1 589 100	—
Hong Kong	5	1841-89	Cession	290	849 800	Included New Territories and leased territory
British N. Borneo	6	1881	do.	31 100	2 010 000	Protectorate 1881
Brunei	6	1888	do.	2 500	30 100	do.
Sarawak	6	1842	do.	42 000	688 000	do.
Cyprus	5	1878	do.	5 600	244 000	Annexed 1914 colony 1915
<b>AFRICA.</b>						
Gold Coast	5 and 6	1870	Settlement and cession	70 800	3 121 000	Dutch settlement transferred 1814. Area and population included Ashanti and N. Territories (protectorates 1890 and 1901 respectively). Administrated Association Island. Protectorate proclaimed 1890
Sierra Leone	5 and 6	1808	Conquest	47	390 000	Administrated Association Island. Protectorate proclaimed 1890
Gambia	5 and 6	1807	do.	4 600	200 000	Colony 1843 and 1888.
Nigeria	5 and 6	1886-1914	Cession and transfer	329 000	19 980 000	Lagos under Sierra Leone 1846-48 and Gold Coast 1874-86 colony and protectorate 1906
Mauritius	5	1810	Conquest	700	383 000	Dutch to 1710. French 1710-1810. Ceded to Great Britain 1814.
Seychelles	5	1794	do.	155	27 400	—
Ascension	Part 1 & 2	1813	Occupation	35	190	—
Tristan da Cunha	—	1810	do.	18	150	—
<b>South Africa</b>						
Cape Province	Prov. of 3	1909	Settlement and conquest	472,300	6,988,600	Administrated S.W. Africa. European pop. 1899 900
Natal	do.	1795	do.	276,950	2,827,700	Area included Natal Bay. European pop. 749 000
Transvaal	do.	1844	Annexation	353,300	1,429,400	European pop. 1,800. Includes Zululand and 189
Orange Free State	do.	1900	do.	110,450	2,087,600	European pop. 696,100. British 177-81
Basutoland	do.	1900	do.	49,700	600,000	European pop. 203,400. British 184-84
Herero and Namaaland	5	1884	Conquest	11,710	600,000	European pop. 1600.
S. Rhodesia	5	1893-95	Cession	280,000	163,000	European pop. 1750.
N. Rhodesia	5	1895	Settlement and conquest	150,800	1,109,000	European pop. 49,900.
Swaziland	5	1911	do.	87,900	123,800	European pop. 14,000.
	5	1900	do.	8,700	123,000	Administrated by High Commissioner for S. Africa. European pop. 200
British Somaliland	5	1884	Cession	65,000	300,000	—
Anglo-Egyptian Sudan	see vol. 8	1898	Conquest	1,008,000	8,605,000	Administrated jointly by British and Egyptian
Sudan	5 and 6	1898	Conquest	221,100	3,041,000	Formerly E. African Protectorate. European pop. 18,000.

Description	Cays	Date of acquisition or cession	How acquired or cession	Area (sq. m.)	Estimated pop.	Remarks
Zanzibar	0	1890	Transfer	1,020	235,400	German renounced interest in exchange for Heligoland.
Nyasaland	0	1901	Conquest	47,000	1,700,000	European pop., 2,000
Uganda	0	1894	Cession	91,200	3,550,000	European pop., 2,000
<b>OCEANIA</b>						
Australia	2	1801	Settlement	2,974,000	6,550,300	Administers Papua. Aboriginal pop., c. 60,000
New South Wales	state of 2	1788	do	300,400	2,526,300	—
Tasmania	do	1803	Transfer	56,400	221,600	Separated from N.S. Wales, 1825
Queensland	do	1824	Settlement	670,000	915,900	Separated from N.S. Wales, 1859
Western Australia	do	1826	do	975,000	421,600	—
Victoria	do	1832	do	87,000	1,804,600	Separated from N.S. Wales, 1851
South Australia	do	1836	do	580,100	585,500	Aboriginal pop., c. 21,000. Annexed to S. Australia, 1867, transferred to Commonwealth Government, 1911, divided into N and Central Australia, 1927; division rescinded, 1931.
Northern Territory	see col 7	1863	do	523,000	4,600 (Whites only)	
Federal Capital Territory	—	1911	Transfer	940	9,200	Created by transfer from N.S. Wales
Papua (British New Guinea)	5	1883	Annexation	20,500	277,000	Area includes d'Entrecasteaux and Louisiade Islands, etc. European pop., 1,100. Administered by Commonwealth of Australia since 1901
New Zealand	2	1840 Dominion 1870	Cession	105,200	1,587,700	Area and pop. include annexed islands. Maori pop., 64,600
Fiji	5	1874	do	7,400	182,600	European pop., 5,100
Pacific Islands	5	1892-1914	Cession and annexation	c. 12,000	c. 200,000	Includes Tonga (Friendly) Islands, Gilbert and Ellice Colony, British Solomon Islands, Pitcairn Island, etc., also New Hebrides (under joint French and British administration.)

**British Honduras**, formerly known as Belize, Crown colony in Central America, on the E coast S of the peninsula of Yucatan. It is bounded by Mexico on the N W and Guatemala on the W and S W. The coast is dangerous from low islands (cays) and coral reefs. The surface inland rises from coastal swamps to high rocky terraces in the W. The forests

are the principal source of wealth, and there is fine pasture on the upper slopes of the W. Mahogany and logwood are the staple exports, and bananas and lemons, etc., are produced. The climate is malarial, although not excessively hot. There is a heavy rainfall for 9 months of the year, especially severe in Nov and Dec. The population is scanty, and of very mixed origin,



THE BEST CARL BROOPE CASTLE ISLE OF WIGHT



CAXTON SHOWING PROOFS TO EDWARD IV  
*(After the study by Maclise)*

## II MANDATED TERRITORIES

Part ion.	T rritories mandated.	Area (sq m)	Est mated pop	Remarks.
A. J. A. Palestine	Great Britain	17 400	1 635 200	Pop 1 ind 770 000 Moslems 175 000 Jews 19 000 Christians 100 000 re 1 hules T dan
[Iraq -	d.	177 100	2 812 00	M 11 inded ex Oct 4 19 2 when Iraq was dm It League of Nations.]
At N. A. S.W. Africa	Union of S Afr & Great Britain	3 2430	63 000	E rope pop 31 600
Tanganyika T rri tory	Great Britain	3 0 600	4 8 4 670	Eur pe pop 6 800
British Cameroon Togoland	d d.	31 200 13 000	771 6 3 76 000	— —
Oceania New C lnd (31 dated Terr tory)	Australia	91 000	3 3 670	Wh t pop 2 000 Chi ese 1 00 Manda in Is' Bismarck Archi pel & New Brit t N w Ireland non Brit h Salomo Island and Admiralty Islands.
W Samoa N uru Isl and	New Ze l and Brit ish Empire	1 250 8	41 000 2 00	— —

including negroes formerly import d as slaves Caribs various American Indian peoples and some European settlers Maya village communities are still found in the N and the remains of Maya civilisation are to be seen in all parts of the colony. There are striking Maya ruins at Lubaantun, Belize (16 690) nearly wiped out by a hurricane in Sept 1931 is the only town of any size transport is chiefly by coastal steamer

The British settlement was begun by buccanniers in the early 17th cent. Other immigrants from the W Indies followed attracted by the wealth of timber These early colonists were self governing and their laws ( Bur nab's Laws ) were recognised by the Crown in 1766 A Crown officer was first appointed in 1786 In 1779 hostility to their Spanish neighbours which had continued thro gh the 18th cent culminated in the destruction of the English s tlement at Belize The British however returned and beat off a subsequent attack Spanish hostility was not dangerous aft r the 18th cent and treaties with the neighbouring Central American States

secured the position of the s tlement British Honduras became a colony subordinate to Jamaica in 1862 and a Crown colony 9 years later Area 8600 sq m pop (1931) 51 350

British Industries Fair a fair originated in 1910 to emphasise the resources and encourage the trade of the British Empire and at first held simultaneously in London Birmingham and Glasgow In 1900 it was reorganised at two sections in London and Birmingham respectively which have remained its homes ever since The former section is organised by the Department of Overseas Trade the latter by the Birmingham Chamber of Commerce and both are subsidised by the Government The following are the figures for the last three years

	Exhibitors	Space (sq ft)	Visitors
1931	2053	60 044	7 461
1932	2253	6 218	463 31
1933	24 3	636 9 6	376 704

The drop in attendance in 1933 is explained by the suspension of free tickets

British Isles, The the collective name for the archipelago

Great Britain and Ireland, with many lesser islands (some 5000 in number), situated on the continental shelf N W of Europe, and geologically continuous with that continent (*see also* ENGLAND, SCOTLAND, WALES, IRISH FREE STATE, NORTHERN IRELAND, and IRELAND). The Isle of Wight, Anglesey and the Isle of Man are the most important of the separate smaller islands. The chief subordinate groups are the Scillies, Hebrides, Orkneys and Shetlands. The Channel Isles are geographically part of Normandy, although politically included in the British Isles.

*Relief.* The British Isles are divided into two well-marked physiological areas. The S.E., including the greater part of England, is continuous with the European plain. The N. and W. including Somerset

until the close of the Tudor era, whilst population did not become really settled until the eve of the Industrial Revolution. Thus, while France, living under similar economic conditions, did not greatly increase her population between the 14th cent. and the death of Louis XIV, that of the British Isles shows a steady increase over the same period. Hardly had this advance ceased before the Industrial Revolution stimulated another and greater one, which has only recently shown signs of abatement. Area, 121,635 sq. m., pop. c. 19,000,000.

**British Legion**, a non-political and non-sectarian association of ex-service men and women who took part in the World War, founded in 1921 by the amalgamation under the title Earl Haig of several societies. In

antiquities manuscripts fossils minerals coins books prints etc Private gifts bequests and official purchases caused the collection to grow rapidly so that in 1813 the erection of the present buildings was begun The main building designed by Sir Robert Smirke was completed in 1845 In 1855 the building of the huge Reading Room relieved the space problem in the library and in 1860 it was decided to remove the Natural History collection to a separate building This building was opened in St Kensington in 1881 and is known as the Natural History Museum The main building in Bloomsbury was enlarged in 1885 by the addition of a new wing built with the money bequeathed by William White The new section was used for displaying pottery glass and prints The last important addition to the Museum buildings opened in 1914 was the Edward VII galleries situated in the rear of the Museum on ground which had been purchased from the Duke of Bedford In 1903 a new section for newspapers was opened at Colindale necessitating the removal thither of 900 tons of English and colonial newspapers this was much extended in 1915

The present huge collection includes rare and valuable books manuscripts prints and autograph letters Egyptian Greek Roman Assyrian Etruscan Cyprian and Oriental antiquities Greek and Roman sculptures of which the Elgin marbles are the most famous coins medals gems ceramics glass British and mediæval antiquities and ethnographical exhibits

The Elgin marbles were brought to England in 1801-3 by Lord Elgin They for the most part came from the Parthenon at Athens and are displayed in the Elgin Room The Egyptian collection contains the famous Rosetta Stone the inscriptions on which provided the key to the deciphering of the Egyptian hieroglyphics The Manuscript collection includes the Harleian and Cottonian MSS and in 1753 the Royal Library (the collection of books

acquired by former kings of England) was added by George II

The Reading Room which can accommodate 500 readers is closed (except by special Day Ticket) to the ordinary visitor to the Museum admission by Readers Ticket is granted by the Director to applicants wishing to use the room for research which is not possible elsewhere if they submit a recommendation from an individual of recognised position The catalogue alone comprises approximately 1000 volumes while in the library itself are included copies of practically every work published in the United Kingdom since 1842 which under the Copyright Laws must be sent to the Museum The total number of works in the library amounts to nearly 4 millions

**Brittany** (*Fr Bretagne*) formerly a kingdom but after 1532 a province of France consisting of the N.W. Peninsula occupying a territory of c. 11 600 sq m with a pop. of c. 3 000 000 Its coast line on the Atlantic and English Channel is rugged strongly indented and in parts treacherous with reefs rocks and islets There are no important mountain ranges the hills are wild in aspect but are not really dangerous The waterways are in the main mere rushing torrents and are rarely navigable of these the Vilaine is the most important

Brittany has in recent years become a holiday resort particularly St Malo and St Brieuc The pottery made at Quimper is still sought a considerable trade being done There are many interesting towns in Brittany apart from those by the sea Rennes (88 000) sprang into notice in 1870 when Dreyfus was tried there Nantes (18 000) famous for the edict issued by Henry IV in 1598 The Romans colonised Brittany for centuries then came an invasion by Celts from Britain fleeing from the Angles and Saxons A protracted struggle with the French monarchy went on almost until the Revolution when the special privileges of the province were finally suppressed



**Brittle Stars**, small starfish (*q v*) of the order *Ophiuroidea*, characterised by their solid, flexible, slender arms, which readily break

**Briza** (*Quaking Grass*, *Pearl Grass*), hardy ornamental flowering grasses which are usually mixed with cut flowers or dried for winter decoration. Any ordinary soil is suitable, in a sunny border. Seeds should be sown in April,  $\frac{1}{2}$  in deep.

**Brno** [BRN'Ń] (Ger *Brünn*), city in Czechoslovakia, and capital of the district of Moravia. It is an important industrial centre for Czechoslovakian textile manufacture, with breweries, machine shops, and sugar refineries. There is a fine cathedral and citadel where Silvio Pellico was imprisoned in 1822-30, an industrial museum, and a modern university (founded 1918). Pop. (1930) 263,650.

**Broach** (*Bharuch*), city in the Gujarat District, Bombay Presidency, British India, a centre of the cotton industry and chief town of a district of the same name. The city is very ancient, and is mentioned under various names by Chinese, Greek, and Latin topographers. It was stormed by the British during the Mahratta Wars. Pop. city c. 43,000, dist. 308,000.

**Broad-Bottom Ministry**, a name given to the Coalition Cabinet of 1714, formed on a wide basis by the alliance of the Pelham ministry and the opposition under Chesterfield, who had recently published a series of letters, under the pseudonym of 'Jeremy Broadbottom'. Pitt was given a minor post 2 years later, and the administration persisted until 1751.

## Broadcasting.

By P. P. Eckersley

A broadcasting system consists of a relatively few wireless transmitters in different parts of a territory to be served, which modulate the intensity of the electric waves they radiate, the intensity of these electric waves being simultaneously appreciated by a

relatively large number of receiving sets. The intensity of the waves radiated by the transmitters is varied sympathetically with sounds made near a microphone connected to the wireless transmitters. Thus, a great number of receivers give out, at the same moment, sounds repeating those made at or near the microphone or microphones which pick up the programme to be broadcast and which are connected to the transmitters.

The several parts of a broadcasting system are shown diagrammatically in Fig. 1.

Sound energises the microphone. The feeble electrical output from the microphone is amplified and passed by land line to transmitter control circuits which modulate the intensity of the high-frequency currents set up in the transmitting aerial by the high-frequency circuits. The modulated high-frequency currents in the transmitting aerial cause modulated waves to be sent out therefrom to fall upon the receiving aerial, and induce feeble modulated high-frequency currents therein. These are selected and amplified in the receiver, and turned into audio-frequency impulses in the receiver detector, the output from which is further amplified, in the receiver audio amplifier circuits, and are passed to the loud speaker which turns these electrical impulses into sound output.

It is convenient to have studios near the centres of large towns and cities. On the other hand, because the strength of radiation near a modern powerful transmitter is overwhelmingly strong, it is essential, to prevent saturating a large number of near-by receivers, to install the transmitters on the periphery rather than in the centre of large towns or cities. Thus, a telephone line, usually from 10 to 20 m. long, connects the microphone amplifier output to the transmitter input.

The transmitter has a double function: (1) to create high-frequency currents in the sending aerial in order that the waves may be radiated there-

from (b) to have arrangements whereby the energy coming from the microphone amplifiers via the land line may be amplified to an extent suitable for modulating the intensity of the high frequency currents in the aerial and hence the intensity of the waves sent out.

Thus there are two sets of circuits in a transmitter called (a) the high frequency circuits and (b) the modulator circuits.

The receiver combines three functions (a) to receive amplify and tune the currents set up in the receiver aerial due to the waves sent out by the transmitter (high frequency selection and amplification) (b) to convert these high frequency currents into low frequency currents suitable for the energisation of the loud speaker.

their energy very rapidly. Also as the length of the waves radiated by the stations is greater so their rate of dying away is less.

It is the object of a good broadcasting system to ensure that the listener hears the programme transmitted with out interruption from extraneous noises. The only way to ensure this is to make the intensity of the signals it is desired to hear much greater than the interferences it is essential should be eliminated. If the wanted signals are weak and the interference strong a very sensitive receiver will magnify both equally it is conceivable that a receiver could be designed which would amplify the wanted signals but not amplify the disturbances just as it is impossible for a human being to hear a concert without hearing his

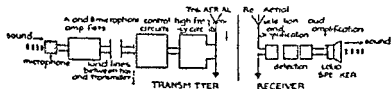


fig 1

(rectification or detection) (c) to amplify these currents after detection to give sufficient power to produce satisfactory volume of output sound from the loud speaker (low frequency amplification).

Section 1.2. The intensity of the strength of the waves sent out by the transmitter increases as they travel farther and farther away from the transmitting aerial. Any energy is dissipated in this way for example it is hotter near to the fire than farther away from it. But the wireless waves which can be appreciated by a receiving set situated not nearly on the surface of the earth must travel between the transmitter and receiver over the earth. In doing so they lose energy. If the ground is wet and fat, the waves travel easily and are not lost by the loss and absorption, the way a wave

neighbour's coughing or fidgeting. It is the magnitude of the ratio of the wanted to unwanted signals which determines the existence of any communication electrical or aural.

In broadcasting practice one can define the area in which reception is good as one in which the waves sent out from the broadcast station are so strong as to shout down any interference. The area is bounded by a line of which signals are too weak to satisfy these conditions.

Of course this boundary line cannot be very clearly defined as a narrow line within which everything is perfect and outside which service is bygone. Because interference varies with locality and because some will listen a great deal better than others. For example, have the service area divided into three grades A, B, and C, service

areas—A being excellent, B good, and C passable. The boundaries of the areas are given in terms of the strength of the electric field created by the waves sent out from the transmitter.

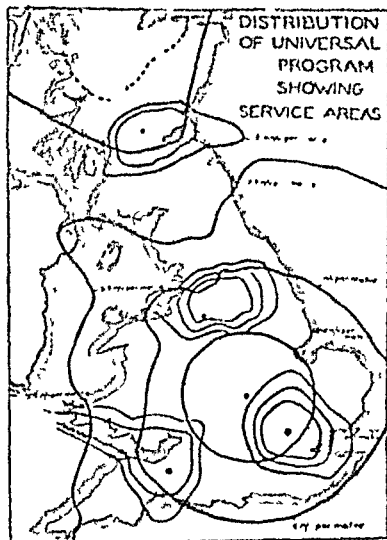


Fig 2

Owing to the fact that the waves lose energy more or less rapidly according to the nature of the ground over which they must perforce travel, and because obviously the nature of the ground varies in different parts of the area surrounding the station, these service area boundaries are not usually circular.

In Fig 2 is shown a map, prepared by the writer when planning the British Regional Scheme of Broadcasting, showing the service areas of the various British stations transmitting the National programme. It should be noticed how these extend themselves over the sea and over flat country, but are contracted by mountains. Notice, furthermore, the advantage of using the long wave (Daventry), which, for a given power, dies away much less rapidly than shorter waves.

**Space Waves.** So far we have only discussed the mechanism of broadcasting, as if all the waves sent out from a transmitting station travelled only over the ground. But a wireless station sends out waves at an upward angle to the ground. It might be thought that these would just fly away into space and be lost. Actually, however, the upper atmosphere (some 60 or so m. above the earth's surface) is electrified. This electrification causes the waves which travel upwards, and therefore unpinge upon it, to be bent earthwards again. This is clearly shown in Fig 3. These so-called space waves do not come in contact with the earth, and so their strength does not die away anything like so quickly as that of the ground waves.

Thus, the radiation from a wireless station takes two forms, (a) the ground wave, and (b) the space wave. At great distances from the station the receiver can only appreciate the space wave, the ground wave has died away, and moreover cannot get round the circular world, since waves must, in broad principle, travel in straight lines.

Two more points bring us to the conclusion of this all-important section. First, this upper electrified atmosphere—called the Heaviside layer, after Oliver Heaviside who first postulated its existence—only reflects "broadcasting" waves at night when the sun's rays do not "break up" the layer. Secondly, this Heaviside layer is not a fixed constant structure always reflecting the waves equally. It turns over, uneasily, in its sleep, like a chang-

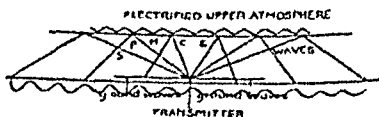


Fig 3

ing bank of clouds, and reflects the waves now strongly, now weakly. Space-ray signals therefore "fade" in intensity from time to time.

The listener will be able to agree

with the correctness of these theories in terms of his own experience. He knows how strong steady and free from interference are those signals which come from his local station. He is within the true ground ray service area of that station. He knows how difficult it is in daylight even with a sensitive set, to get distant British stations without interference (outside service area). He knows how at night the strength of foreign stations rises to extraordinary levels and yet he also knows that such signals fade (indirect ray phenomena). Lastly he is aware that long wave foreign stations give him a steady service day or night (he is within their (very big) service areas).

*Mutual Interference between Stations*  
Obviously we can conclude from this argument that a wireless station is appreciated by a receiver at very great distances from the sending station because of this indirect or space ray phenomenon. Thus if we were to put two stations even separated by thousands of miles in geographical distance on the same or nearly the same wavelength they would interfere with one another. A receiver it is true has means to select a station transmitting on one wavelength from another transmitting on another wavelength (tuning) but obviously no mechanism could be devised to separate two stations of comparable strength transmitting on the same or nearly the same wavelength. This means that every station likely to be transmitting in the same continent wide zone of darkness has to have its own channel or wavelength which is separated in wavelength by a definite current from all other wavelengths used by other stations.

But wireless is used for all sorts of purposes not only for broadcasting. Channels of wireless communication are precious because few. In effect the broadcasting services of the world are given only about 100 different channels and so can only employ simultaneously 100 different stations

in one continent. This means that each nation in Europe must try to arrange its service in terms of far fewer channels than are technically desirable. There are about 30 stations in Europe each claiming facilities for broadcasting and wanting if perfection is to be achieved on the average 10 channels for a proper national scheme of broadcasting. Three hundred wavelengths might allow an adequate continental service.

*Organisation of Broadcasting Services*  
Wireless in general is international in character because considered as a means of communication between nations international co-operation is essential but also because as we have seen the erection and operation of a station in one country may (if no agreement as to channel allocation is reached) interfere with the operations of another station in another country.

Thus from the beginnings of wireless the right to allocate the wavelength power and location of a station has been vested in Governments. The Minister of Posts and Telegraphs or as we say the Post Office is the instrument of Government in this matter.

When broadcasting was first proved practicable the administrations dealing with communication in general and wireless in particular had to be consulted before the necessary permissions to erect the transmitting stations could be obtained. From the beginning of broadcasting therefore the Government has been the ultimate authority controlling more or less the form of the organisation of the service.

It is erroneously supposed by some that the control of broadcasting was centralised in one authority because the invention had such great potential political and cultural influence. At the time of the inception of broadcasting however these potentialities were no more appreciated than were the similar potentialities of the cinematograph when first exploited as a commercial venture.

But, when broadcasting was first

mooted, the Postmaster-General was necessarily petitioned by many would-be manufacturer, of wireless receiving sets for permission to erect transmitting stations in order that there might be a service enabling receiving sets to be sold. Embarrassed by the volume of the demands, at a loss to allocate a sufficiency of waves for a multitude of stations, and deterred by American experience, he wisely decided to recommend that the manufacturers themselves should combine their interests in the transmission system, but compete among themselves for the patronage of the listener when the latter wished to equip himself with a receiving set.

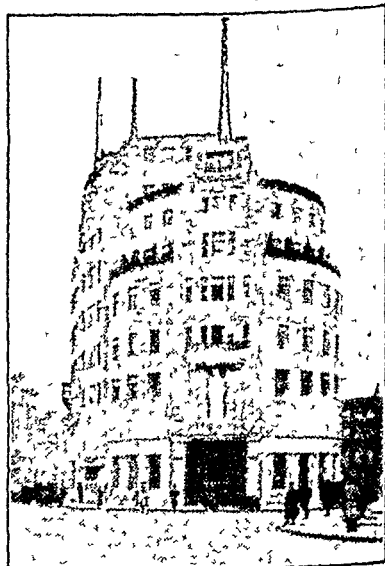
Thus, the British Broadcasting Company was formed in 1922 as an association of wireless receiving-set manufacturers. The capital of the company was subscribed for by these manufacturers. The directors of the company were the managing directors of the larger wireless companies who had made the larger contributions towards the capital. The companies behind the original British Broadcasting Company, formed in Nov 1922, were Marconi's Wireless Telegraph Co., Western Electric Co., Metropolitan-Vickers Co., British Thompson-Houston Co., General Electric Co., and the Radio Communication Co. The capital of the British Broadcasting Company was £100,000, and £60,000 of this was subscribed by these firms. Part of the balance was subscribed by smaller wireless companies. At a later date the Burndept Company and the Bell Company were asked to appoint representatives to the British Broadcasting Company board. The revenue of the company was then, as now, mostly derived from the subscription of 10s per annum paid by the listeners to the Post Office in return for the right to possess and use a wireless receiver.

In 1926 the old company was dissolved, and the British Broadcasting Corporation was established, free from any commercial influence, under Royal Charter. This Charter is due for

reconsideration in 1936. The Charter instructs the British Broadcasting Corporation to carry on the service "to the satisfaction of the Postmaster-General."

This very brief résumé of the constitution of our broadcasting organisation is given to illustrate a typical form of organisation which may be classed as a public utility corporation. Most European countries have organised their broadcasting service on similar, if not identical, lines, or are about to do so.

American broadcasting is run basic-



Broadcasting House, London

ally as a means to advertise commercial products of all kinds. It was pioneered by the Westinghouse Company of Pittsburgh (Pa.). This corporation experimented, c 1919, with transmitting stations, and enthusiasm and interest were thus aroused. It became obvious that broadcasting was a novel way for commercial firms to obtain publicity. From 1918 to 1920 all sorts of organisations, from religious

societies to the owners of large stores newspapers etc applied for and got permission to erect stations. The Secretary of Commerce was compelled by the then existing laws of the U.S.A. to grant these permissions. It will be realised from an understanding of the technical discussions which began this article that very soon American stations began to interfere one with another to their mutual disadvantage. There were at one time over 500 different stations in America all transmitting at once. New laws were eventually made preventing a further indiscriminate prancing of licences. Gradually however restriction became automatic because the improving standard of public appreciation demanded an expenditure on the programme material surrounding the advertising of this and that product outside the sustained financial capabilities of many organisations who had rushed unwarily into this new field of advertising technique.

Some of the big wireless interests notably General Electric Westinghouse and R.C.A. then formed an organisation (the National Broadcasting Company) which erected and operated stations or acquired the right to operate existing stations to form a continent wide radio broadcasting system. The idea was to sell broadcasting time to would be advertisers. Thus the advertiser was able to buy from the National Broadcasting Company broadcasting time exactly as he was accustomed to buy newspaper space for advertising. The advertiser was thus freed from all technical responsibility involved in operating a broadcasting station. Later on an organisation similar to the National Broadcasting Company called the Columbia Broadcasting Company was formed to compete with the pioneer company.

In America to-day programmes are "free" and the listener does not pay a licence fee but each programme is sponsored by an advertiser. Thus one hears of the "X hour" the "Y

hour" sponsored by the "X or Y Company" but given over the air by the National Broadcasting Company or Columbia Company. The revenue to maintain the broadcasting system is derived partly from the profits on the sale of receiving sets and partly from the money paid to the broadcasting company by the advertiser. At the same time some individually owned and run broadcasting stations still exist but these are frequently hired for longer or shorter period to the National Broadcasting Company or Columbia for the purposes of a nationwide broadcast.

Certain French stations to-day operate under the American system and give advertising programmes both in French and English intended respectively for French or English consumption. The Irish Free State station at Athlone is occupied in a similar capacity.

Many projects have been mooted to erect stations in Europe of high power and wide service area purely for the object of advertising but difficulties have been put in the way of achieving anything very definite owing to opposition from the public utility companies and through them by Governments.

*Growth of Broadcasting* European broadcasting was started in England in 1919 when the Marconi Company erected a 15 kw long wave station at Chelmsford Essex. This station was shut down by order of the then Postmaster General after a few months working because it was said to interfere with legitimate services.

A Dutch station (P.C.C.G.) at The Hague continued to be run for some years from 1919 onward its revenue being maintained by private subscription.

American broadcasting also began in 1919 and has been expanding ever since.

In 1920 the Radio Society of Great Britain (a society of wireless amateurs) petitioned for a broadcasting station

so that they might have means to study reception problems. Their petition was eventually granted, and in 1921 a station of very low power (0.2 kw) was erected at Writtle, near Chelmsford, and operated by a section of the Marconi Wireless Telegraph Company's staff. The writer was in control of this original broadcasting station. Transmissions were given for half an hour a week, every week from early 1921 until late 1922. This was the first regular service of broadcasting given in England.

In 1922 the Marconi Company erected a station (2LO) on the roof of Marconi House, and carried on transmissions of an experimental character. This resulted in awakening the general public's interest, and in consequence, in Nov 1922, a company, the British Broadcasting Company, was formed in the manner already described.

The British Broadcasting Company was under contract to erect and maintain 8 stations of  $1\frac{1}{2}$  kw. These were to be located in Aberdeen, Glasgow, Newcastle-upon-Tyne, Manchester, Birmingham, London, Cardiff, and Bournemouth. A so-called main station was later erected at Belfast.

The service from these stations being adequate only in their immediate environs, the following developments took place:

End of Dec 1922 London, Birmingham, Manchester, and Newcastle main stations opened.

End of March 1923 Cardiff and Glasgow main stations opened.

End of Dec 1923 Aberdeen and Bournemouth main stations, and Sheffield relay station opened.

End of June 1924 Plymouth, Edinburgh, and Liverpool relay stations opened.

End of Sept 1924 Leeds, Bradford, Hull, and Nottingham relay stations opened.

End of Dec 1924 Stoke, Dundee, and Swansea relay stations and temporary high-power station at Chelmsford opened.

End of March 1925. Power of London station increased.

End of Sept 1925 High-power station at Daventry opened and Chelmsford discontinued.

At the beginning of broadcasting, only those possessing sets manufactured by member companies of the British Broadcasting Company and of types approved by the Postmaster-General were allowed to take out licences. It was, in fact, illegal to have a home-made set, and impossible to take out a licence for it. The number of home makers became, however, so considerable that their existence, and their desire to pay for and possess a licence, were, at last, in Oct 1923, officially recognised to the great advantage of the British Broadcasting Corporation's revenue. A graphical representation of licence growth clearly shows the sudden increase of licences when the "home maker" was included in the licence total.

The Table which follows (p 195) shows development in other countries, and gives the proportion of the population calculated or known to possess wireless receiving sets.

*International Aspects*—It will be appreciated that, since there are roughly only 100 channels available for all the broadcasting stations of Europe, W Russia, N Africa and Turkey in Asia, international agreements must be reached in order that a fair partition of wavelengths shall be made between claimant nations.

The writer appreciated in 1924 the potential danger of uncontrolled multiplication of European stations. A letter was in consequence addressed from the British Broadcasting Corporation to the responsible authorities in Europe calling attention to the technical facts and their obvious implications.

In March 1925 a conference was held at the British Broadcasting Corporation offices, attended by delegates from 10 European countries. It was then agreed to form an international Union, with headquarters in Geneva. The





assistance of governments in ratifying and maintaining the Brussels plan that a conference was convened at Prague in 1929, at which members of the Union collaborated with members of the postal administrations of all Governments.

Twenty-eight nations were represented at Prague, and something like 150 delegates took part in the deliberations. The meeting achieved the production of a new plan, called the Plan de Prague.

The Union technicians were at pains to show that the plan was no more than a point of departure and that, as new technical knowledge was gained, or as the situation changed, it should be modified. The Union technicians continued also to press governments for an allocation of more suitable waves for the broadcasting services than those existing.

In 1932, at the World Conference at Madrid, however, the situation remained much as before, and the Plan de Prague continued to be applied, in spite of the fact that the greatly increased power of stations caused a great deal of mutual interference between them, the Prague plan being, at best, a compromise based upon a certain status quo.

The Union and the governments met again at Lucerne in May 1933 to attempt to prepare a new plan to replace the Prague plan. In fact, a paper plan was produced (the Plan de Lucerne), but owing to the failure of the conference to appreciate the technical bases of broadcasting, this new plan merely crowded more stations into an insufficient band of wavelengths, and the foundations of a complete future debacle were well and truly laid. Some very good work has been done at Brussels, the technical headquarters of the Union, where a control centre has been established in order to keep a check upon stations in regard to their observance of frequency stability, or, in other words, to determine which stations do not adhere strictly to their agreements to keep transmitting accu-

ately on the wavelengths allocated to them.

Owing, however, to the growing political significance of wireless, the desire on the part of nations to make broadcasting a means of national and international propaganda, and the tendency to advance purely national interests to the disadvantage of the European listener, the Union's technical work has been consistently emasculated.

If these tendencies continue to be converted into actualities, wireless broadcasting must fail in its primary function to give the listener a choice of easily heard and easily picked-up programme material.

*The Receiving Set* The receiving set embodies three distinct functions: (1) selection (or tuning) and amplification of high-frequency currents, (2) the rectification of these to produce low- or audio-frequency currents copying in intensity the modulations of the high-frequency currents, and (3) the amplification of the frequency currents to an intensity sufficient to operate the loud speaker.

Notable advances have been made in the technique of wireless reception apparatus. The set of only a few years ago could not be handled by any but the skilled tuner, or selection of the station it was desired to receive, was achieved only by having several different-tuned circuits, each requiring separate and independent adjustment. The introduction of the "ganged" condenser, that is, a condenser having several units but each variable by the same amount by the turning of one knob, has done much to make "tuning" "foolproof."

High-frequency magnification has been greatly improved by the introduction of the screen grid valve, which enables the designer, if he screens circuits properly, to do away with stabilisation circuits of complicated design which are otherwise necessary to prevent the circuits oscillating.

Detection in terms of power grid-leak rectification in conjunction with

high frequency magnification is almost perfect and supersedes the old methods which introduced considerable distortion.

Low frequency amplification has been greatly improved by the use of multi-electrode valves having high efficiency.

The set of a few years ago involved the use of many adjustments, batteries, straggling wires and many separate boxes. To-day the compact all metal construction and the fewer and cheaper components enable the whole set to be conveniently boxed complete as a unit with its loud speaker. Frequently no external aerial or earth is necessary to achieve a reasonable choice of programme.

The future will see technological improvements making a set which functions equally efficiently whatever the wavelength it is tuned to; the manufacturer will produce a better and better quality for a given capital cost and receiving apparatus will be able to be operated by quite unskilled persons.

There is nevertheless a fundamental bar to the perfection of receiver technique which would evolve of itself were it not for the failure of transmitters to keep pace with existing knowledge.

It has already been shown that transmitting stations are increasing in power and number without provision being made to give them adequate channels on which to enjoy uninterrupted service. This forces the receiver designer to make his sets so selective as to spoil any possibility of the production of good quality sounds from the loud speaker.

The mutual interference between stations, the fact that distant signals fade and the inevitable interference in summer time from atmospheric static must limit the listener's facility to receive either clear signals or a wide range of programme choice from his receiving set unless there is a fundamental change of ideology in the technique of transmission.

*Rediffusion.* In 195 a young man in Holland (A. Bauling) conceived a broadcast receiving system in which was set up an ordinary wireless receiving set the output from which was amplified to a strength sufficient to energise not one but perhaps 1000 loud speakers. Wires were run over the tops of houses attached to brackets on chimneys to subscribers who were equipped with loud speakers connected to these wires. Thus as many as 1000 loud speakers could be energised from the single central receiving set. Programmes could be thus collected from the air and rediffused to subscribers by wire. The writer has therefore given the name Rediffusion to this type of broadcasting system.

The Dutch development has been considerable. To-day over 50 per cent of the listeners in Holland receive their programmes from central receivers through specially erected wires.

The development of rediffusion in Britain has been less rapid. It was started in 197 at Clacton-on-Sea and soon afterwards at Hull. A system ran concurrently at St. Annes-on-Sea.

To-day out of the 6 million listeners in Great Britain something like 100,000 persons obtain their broadcasting entertainment by subscribing to a rediffusion centre. It is the usual practice for the private exploiting company to charge the consumer a weekly rental of 1s 6d and to ask him to pay a minimum of 6d a week to purchase the loud speaker which becomes his property when he has paid the retail price of that speaker. He can choose any type of speaker he cares to after demonstration. Every subscriber to a rediffusion system must buy the ordinary annual licence.

The largest rediffusion centre in the world exists at Hull with over 13,000 consumers involving 12 amplifying stations each capable of 200 watts of undistorted output per programme. 110 programmes are given and the wiring run on brackets attached to householders' chimneys and looking

rather like overhead telephone wires, consists of 4 wires, i.e. 2 circuits each having a go and return wire.

There are c. 100 different private companies exploiting rediffusion systems in different towns and cities throughout the country.

The system recommends itself to listeners principally for its convenience, particularly where no electric mains are available for the energisation of all-mains receiving sets. Other recommendations are (1) that it is more economical for poorer people who do not have any maintenance charges for new valves, batteries etc., and who know their weekly commitments in advance, (2) that the quality of reproduction can be better than that normally achieved by a cheap wireless receiver, (3) that the single receiver, the output from which is amplified and distributed to consumers, can be located where interference is at a minimum and the wanted signals at a maximum in the district.

No private company may start a rediffusion system unless it obtains a licence from the Postmaster-General. The most important clauses of this licence lay down

1 That the Postmaster-General has the right in 1936 to "take over" the company at a figure based only upon material costs incurred by the company, i.e. there is no allowance for goodwill or profits.

2 That the company shall not "connect" subscribers unless assured that that subscriber has paid his 10s licence fee.

3 That the Postmaster-General has the right to forbid the rediffusing of any programme at any time, and that particularly no foreign programme containing spoken English advertising matter shall be relayed to subscribers.

The private company wishing to start rediffusion must also obtain permission, from the local town council, to cross public streets with wires. It is the general practice to make an agreement with the town council to pay a proportion (sometimes as much

as 7½ per cent) of the profits to the Town Council in return for the right to cross streets with wires, and on the assumption that no other company shall obtain such permission but, if they do, that the payments to the town council shall cease. This arrangement probably could not be held to be good in law, but it constitutes a "gentleman's agreement," and is so observed.

The Postmaster-General will not agree to allow any one company to operate in more than a limited number of towns, so that one company cannot in the present circumstances obtain a monopoly over rediffusion. The limit is placed at 2 million population, or c. 200,000 houses, meaning about 100,000 subscribers in all.

Rediffusion is not developing in Great Britain as rapidly as it might. It is difficult to raise the required capital because of the clause in the licence which says that the Postmaster-General may take over the service in 1936. The wireless trade is rigidly opposed to a scheme which does away with the receiving set of common usage. In spite of the many restrictive clauses in the Postmaster-General's licence, the British Broadcasting Corporation is, nevertheless, opposed to an extension of the system unless they themselves control it as a part of transmission technique. An official article on Rediffusion in the *BBC Handbook* for 1933, pp 71-2, contains the following:

"No wireless exchange company has any monopoly within a particular area. This, of course, may discourage technical development. The particular aim of a wireless exchange is to provide clear and constant reception and a service on easy payment terms to those without much capital. The system, however, contains within it forces which, if uncontrolled, might be disruptive of the spirit and intention of the British Broadcasting Corporation's charter."

The British Broadcasting Corporation thus emphasises its monopoly at

**Broccoli**, green vegetable resembling the cauliflower but with small heads several on one stalk

**Brochure** [BRÖSHUR] literally something stitched together a term applied to a little pamphlet or booklet and specifically to a mono-graph or article upon some particular subject printed in book form

**Brock**, Sir Thomas (1847-1909) British sculptor whose chief work was the Imperial Memorial to Queen Victoria facing Buckingham Palace Prominent among his other important works are the Lord Leighton monument in St Paul's Cathedral and the equestrian statue of *The Black Prince* at Leeds

**Brocken**, granite mountain in Prussian Saxony Germany and the culminating point of the Harz range In German legend it was long supposed to be the site of an annual witches sabbath The spectre of the Brocken an illusion caused by reflection from its mists probably helped to give the mountain its uncanny reputation The Brocken is a very popular mountain among tourists Height 3730 ft

**Brodie**, Sir Benjamin Collins (1783-1861) the elder was Sergeant Surgeon to Queen Victoria For many years at St George's Hospital he produced many works on medicine which now are of historical though not scientific value In *Medico-Chirurgical Transactions* he describes the first subcutaneous operation on record He removed a tumour from the scalp of George IV He was first President of the General Medical Council and a member of many foreign academies

**Broghe**, distinguished French family of generals and statesmen founded by François Marie (1611-1666) of Piedmont His grandson FRANÇOIS MARIE Duc de Broghe (1671-1747) marshal of France served in the Wars of the Protestant Spanish, Polish and Austrian Successions was Governor of Alsace 1740 and Duke in 1749 Victor FRANÇOIS Duc de Broghe (1718-1804) marshal of France

opposed the Revolution and left France VICTOR CLAUDE Prince de Broghe (1757-1794) a revolutionary and Jacobin was executed during the Terror ACHILLE CHARLES LEONCE VICTOR Duc de Broghe (1785-1860) diplomatist Foreign Minister and Premier under Louis Philippe devoted himself to literature after the 1848 revolution JACQUES VICTOR ALBERT Duc de Broghe (1821-1901) prominent in politics after 1872 as Foreign Minister and Premier 1877 His son Louis VICTOR Prince de Broghe (b 1892) is a physicist of renown and won the Nobel Prize for Physics 1909

**Broiling** see GRILLING

**Broken Hill** (1) Mining town and third city of New S Wales The ores now worked are usually sulphides of silver lead and zinc Mining began in 1883 and the upper deposits are now worked out Pop (1931) 2,900

(2) Settlement in N Rhodesia with zinc and lead mines in the vicinity A celebrated skull of early man (*Homo Rhodessensis*) was found in a cave near by in 1901 Pop less than 100

**Broker** an agent who concludes a contract between buyers and sellers receiving a percentage brokerage or commission on the transaction Brokers usually specialise in some particular market from which they take their names as cotton broker producer broker stockbroker bill broker insurance broker A broker as such never enters into possession of the goods passing nor does he act in his own name only carrying out the instructions of his principals Upon the completion of the contract his function ends To-day in most markets brokers act through the exchange established for the prosecution of that particular business On the Stock Exchange (qv) the broker buys or sells securities for his clients from or to the authorised dealers charging brokerage which varies with the security from 1/4 per cent to 2 per cent

**Bromal**, the bromine analogue of chloral (qv) It is a colourless liquid

helping, we shall see a world inter-linking.

Television may come but probably more in terms of expensive wire circuits than by air. The use of ultra-short waves is problematical, because of their extremely erratic behaviour where the would-be listener lives among steel-framed buildings and where motor cars may set up (in ignorance) interference.

To sum up, one foresees the listener of the future paying a rental for a service which as far as he is concerned involves the choice by the mere operation of different switches of programmes which may be classified as International, National, Regional, and Local. Each of these classifications may, indeed, be subdivided as speech and music, and these in turn may submit to further subdivision. In 20, 50, 100 years' time—who knows what barriers may yet be erected to delay technical progress?—twenty buttons and a loud speaker may make broadcasting a means to force us to realise that, as human beings, we are alike the inheritors of intelligence, and that, marooned in infinite space, we have a common problem, a problem soluble only by the realisation that the world is a single economic and cultural unit.

**Broadmoor**, a State asylum for criminal lunatics situated near Wokingham, Berkshire, built in 1863, with accommodation for 700 persons.

**Broads**, The, stretches of inland water of varying size scattered over S.E. Norfolk. There are over 30 broads in Norfolk, and one, Oulton Broad, near Lowestoft, in Suffolk. The lagoons, of shallow depth, are connected to the R. Bure, Yare, and Waveney, by means of dykes. They cover in all c. 5000 acres. Hickling Broad, covering 400 acres, is the largest; it is frequented by small yachts. Filby, Ormesby, and Rollesby broads are the largest stretch of water, together forming 600 acres. Ormesby broad is only 2 m. from the sea. Wroxham, a mile long and 120 acres in extent, the most

important of the important broads, is c. 9 m. from Norwich. Stalkham Broad is noted for its white water lilies; the waterway, however, is steadily being choked up with aquatic vegetation. At Horstead Little Broad, near Wroxham, the black-headed gull has selected its favourite breeding-place. The widest Broad is the 50 acres of water at Rockland, which the profusion of reeds and rushes, the variety of wild fowls, and the abundant bird life invest with a strange ruggedness. Sailing, fishing, and shooting are the principal pastimes on the Broads.

**Broadsides:** (1) A sheet of paper, printed upon one side only, and used for proclamations, notices, songs, news, political agitation, and criminal reports before the popular acceptance of newspapers, i.e. up to the end of the 18th cent. Also a large single-sheet advertisement, folded and sent through the post. (2) A discharge of all the guns upon one side of a warship, rendered obsolete by the introduction of gun-turrets.

**Broadstairs**, watering-place in the Isle of Thanet, Kent, England. Pop. (1931) 12,718.

**Brocade**, fabrics ornamented with designs woven in relief, so that they appear to be embossed on the material. Silk brocades are mentioned in Chinese records as early as the 3rd cent. A.D., while in Europe the art was introduced by weavers from Persia and the East probably in the 11th cent. The design is frequently brocaded with gold and silver threads, and magnificent brocades were manufactured in Italy and Spain in the 12th and 13th cents and somewhat later in France. Spitalfields was the chief English, and Lyons the chief French, centre of brocade weaving in the 18th cent.

**Brocades of Cotton** is the technical term for a number of cotton fabrics woven on Jacquard looms, such as are frequently used for tablecloths, bedspreads, and curtains, with slightly raised designs, and frequently reversible.

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**Bromal**, the bromine analogue of chloral (*qv*). It is a colourless liquid

boiling-point  $174^{\circ}\text{C}$  Chemically it is tribromacetaldehyde, having the formula  $\text{CBr}_3\text{CHO}$  Used medicinally as a sedative.

**Bromberg** (Polish *Bydgoszcz*), important railway centre in Poland, near the Vistula, in the province of Poznan, distributing centre for agricultural produce, with various industries connected with woodwork, formerly of considerable strategic importance as a Polish outpost Pop (1931) 117,500

**Bromides**, chemical compounds of the element bromine with one other element The metallic bromides are salts, derived from hydrobromic acid (hydrogen bromide) by replacing the hydrogen by the metal Compounds of bromine with non-metals, e.g. phosphorus pentabromide, are not salts The commonest bromides are those of sodium, magnesium, and potassium, the first two occurring in association with beds of rock-salt Bromides are a source of bromine, which is manufactured entirely from sodium or potassium bromide, and used in photography and in medicine

In photography the sensitive surface of a plate is formed by a layer of silver bromide which, after exposure, is treated with a reducing agent, or "developer," the simplest being potassium-ferrous oxalate This reduces the silver bromide to metallic silver in proportion to the amount of illumination undergone during exposure, and thus there is a heavy deposit of silver over the illuminated part of the surface, which represents the brightest part of the object photographed Conversely, the darkest parts of the object are represented by transparent areas on the plate, and so the image is a "negative" When sufficient contrast has been obtained, the developer is removed, and any surplus silver bromide is dissolved out with "hypo" (sodium thiosulphate) Thus a silver image remains as the negative "Bromide" papers are used to give the final print or "positive." In medicine, bromides are valuable nerve sedatives,

potassium bromide especially being used to slow down the action of the heart and brain

**Bromine.** For the characteristics of bromine, see ELEMENTS.

Bromine is a liquid element belonging to the group known as the halogens It is not found free in nature, and is usually obtained from the bromides of sodium, potassium, and magnesium, which are found in sea-water, mineral springs, and certain salt deposits such as those at Stassfurt in Germany and in Chile Bromine is industrially prepared by the action of chlorine on concentrated brine mother-liquors, and also by the electrolysis of the waste brine of the salt industry The latter process is more especially employed in the United States Bromine is of extreme importance in the chemical industry, since it enters into a very large number of organic reactions Its use in organic chemistry is due to its great chemical activity, since it forms either addition or substitution compounds with a very large number of organic substances In the elemental state bromine is used when mixed with diatomaceous earth as a disinfectant for rooms and buildings A large number of organic bromine compounds are used in synthetical chemistry Bromine compounds, both organic and inorganic, also find a considerable use in medicine as sedatives in nervous cases Potassium bromide is largely used for this purpose, and also finds employment in photography for the manufacture of printing papers. Bromoform, the bromine analogue of chloroform, is used medicinally as a remedy for whooping cough

**Bromoform** (*tribromomethane*),  $\text{CHBr}_3$ , the bromine analogue of chloroform, it is a heavy colourless liquid boiling at  $151^{\circ}\text{C}$ , which resembles chloroform in its odour It can be manufactured by the action of bromine on alcohol or acetone

It is used in medicine to relieve whooping-cough, on account of its high specific gravity (2.9) it is also

employed to separate minerals of varying densities

**Bronchiectasis** a disease of the lungs in which large quantities of purulent sputum are coughed up each morning on waking and at intervals during the day. The condition usually dates from childhood and can be traced to some such infection as whooping cough or pneumonia. The patient's complexion is pasty and pimply. A chronic nasal discharge may be another complication. Most typical of all the symptoms however is a curious clubbing of the fingers. This in a person with an offensive breath is an almost certain indication of the presence of the disease.

The condition consists in a scarring of the lung tissue as a result of the original infection. As a sequel to this portions of the lung have lost their elastic and contractile properties and take the form of dilated sacculi into which lung secretions drain. The sacculi gradually become filled with fluid but owing to the non-contraction of the damaged lung the fluid is not easily expelled. It is only when the fluid in the sacculi begins to overflow into the surrounding healthy lung that the lung is sufficiently irritated to give rise to coughing. The only method by which the lung can be completely drained is by arranging the posture of the body so that the mouth is lower than the chest. In this way the accumulated fluid can flow away from the lung by gravity. This postural drainage may in bad cases yield several pints of fluid per day.

There is no known way of effecting a repair to the damaged parts of the lung. Secondary infection is liable to settle in the lung and this can be kept at bay to some extent by the use of iodine as a lung disinfectant. Attempts have been made to bring about collapse of the affected part of the lung and so effect a cure while surgical excision of the part of the lung concerned is also being attempted.

**Bronchitis**, catarrhal inflammation of the larger and medium-sized air

tubes in the lungs. In the early stages of the malady the mucous lining of the air tubes becomes inflamed and in consequence the mucous cells produce an increased quantity of secretion which has to be ejected from the lungs by coughing. Some of the cells of the mucous lining become devitalised the surviving cells replacing those that are lost. The cause of the bronchitis may be nothing other than dust and if such is the case the irritating particles are washed away by the secretion and coughed up. The expectoration is at first always clear and watery. But if germs are the real cause of the trouble the effect of these is apt to be superimposed upon the effect of dust and the secretion begins to get opaque and muco-purulent. There is then a tendency for the infection to spread into the deeper layers of the walls of the tubes. Although complete recovery and return of the lung to normal is possible after such a spread yet in senile adults or in ordinary adults suffering from repeated attack the lung becomes so scarred that it gives rise to a condition of chronic bronchitis or winter cough. Once the condition has become chronic changes take place in the lining mucous membrane and in the underlying tissue which are permanent, and which make a complete return to normality impossible. The lung thus damaged and subject to the strain of much coughing tends to lose its elasticity and become permanently blown out a condition known as emphysema. This type of bronchitis is confined to the larger and medium sized branches of the air passages.

There is another kind which is seated in the smallest terminal branches of the air passages. This is known as capillary bronchitis and is the invariable precursor of and in fact is the early stage of broncho-pneumonia. A third type of bronchitis is a chronic condition resulting entirely from the breathing in of powders such as those from asbestos, silica or coal



It consists in a general fibrosis of the lung, and permanent impairment of its healthy state. This type of bronchitis often receives the name asbestosis, silicosis, or anthracosis, according to the particular dust concerned.

Ordinary bronchitis occurs in adults of any age, and only becomes chronic in people of advancing years, or declining health. Capillary bronchitis, on the other hand, with its serious complication of bronchopneumonia, occurs only at the extremes of life, in infants, or very old people, except during influenza epidemics, when it occurs in adults of all ages.

Brontë [*pron* BRON'tā], Charlotte (1816-1855), Emily (1818-1848), and

Anne (1820-1849), novelists, were born at Thornton, near Bradford, in Yorkshire. In 1820, their father, the Rev. Patrick Brontë, became incumbent of Haworth, near Keighley, Yorks, where they lived



Emily Brontë

until their deaths.

In 1846 they published, at their own expense, *Poems*, by Currer, Ellis and Acton Bell, which was a failure. In 1847, a novel by each of the sisters was published, *Jane Eyre* by Charlotte, *Wuthering Heights* by Emily, and *Agnes Grey* by Anne. Emily died in 1848, and Anne in the following year. This tragic blow did not, however, deter Charlotte from continuing to write, and in 1849, *Shirley*, and in 1853, *Villette*, were published. She married her father's curate, Arthur Bell Nicholls, in 1854, but died herself in the following year.

Of the three, Emily was probably the greatest writer, her poems are considered among the best that have been

written by women, and her novel, in its grim and passionate intensity, is unique. Charlotte's work is perhaps remembered more for its author than for itself, for in it her strong personality is easily discerned. Mrs. Gaskell's *Life of Charlotte Brontë* is the standard biography.

Brontosaurus, *see* REPTILES

Bronx, The, suburb and borough of New York City, U.S.A., formed by the amalgamation of several separate towns, N. of the main city. The New York Zoological Park (Bronx Zoo) is in this district. Pop. (1930) 1,265,300.

Bronze, an alloy of copper with some other metal, usually tin, easy to work, and at the same time very durable. It was first used in prehistoric times, and gave its name to the Bronze Age (*qv*). The earliest extant bronze implement is estimated as 3500 years old. From c. 2000 B.C. it came into wide use in the Mediterranean countries, and starting with plain blades, arrow heads, and pots, developed into production showing a high degree of skill, e.g. sword blades engraved and inlaid, bowls with ornamental bands, and statuettes, all of which have been found in Crete and Cyprus. Later, with the advent of the Iron Age (*qv*), bronze was relegated to ornamental use. Etruscan graves in Italy have yielded many fine specimens of Assyrian bronze-work, apparently made c. 800 B.C. Under the Romans ornament on bronze objects began to be carried out by engraving designs, as well as the older repoussé (hammered design). Some 600 years B.C. the art of casting was developed and monumental sculpture was carried out in bronze.

By the 10th cent. A.D. skilled workers in bronze were distributed all over Europe, and numerous towns, such as Hildesheim, with its bronze font, and Innsbruck, with the tomb of Maximilian I, bear witness to later artistic ability. Henry VII's tomb in Westminster Abbey is a good example of 16th-cent. Italian work. Perhaps one of the best-known works of art in bronze is the exquisite pair of doors at

the Baptistery Florence designed by Lorenzo Ghiberti

In the East bronze has been in use nearly as long as in the West. China produced consistently fine work for many hundreds of years in the form of vases and bells for ceremonial use. These are not only engraved but also ornamented with additions in high relief. In India the characteristic ornamental feature is filigree the practice of piercing designs which result in a lace like effect is used effectively in bronze work.

In the course of time bronze acquires a beautiful patina either green or blue according to the influences to which it has been exposed and the present tendency in sculpture in bronze is to produce this artificially.

Oxidised bronze is almost entirely replacing brass in modern architecture as its appearance is more attractive and it does not need so much attention. See also ALLOYS.

**Bronze Age (The)** The Bronze Age is a deceptive term inasmuch as it does not express a distinct phase in the world's history. To speak of the Bronze Age in Egypt the Bronze Age in Asia Minor the Bronze Age in Europe etc is more nearly correct but this still does not involve anything approaching contemporaneousness. Copper was known in Egypt in 4400 B.C. two thousand years earlier than in Asia Minor and two thousand five hundred years earlier than in Europe.

**Methods** From early Egyptian sources we learn how lumps of metallic ore were laid upon glowing sticks of charcoal whilst youths sat round blowing tubes to provide the forced draught causing the metal to drip through the embers into a clay crucible below. Later the firing power was replaced by leather bellows and the crucible by a mould either fashioned in clay or engraved in stone. This is known as the open hearth process, and produced articles in relief on one side and upon the other which represented the face of the molten metal.

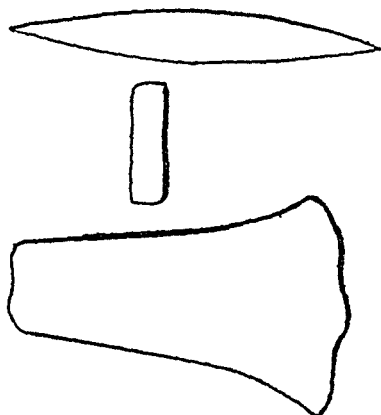
The earliest valve moulds have come down to us from Middle and late Bronze Age Europe. These consist of blocks of stone smoothly faced with the negative of half the object to be cast engraved in them. These halves needed to be locked together and are sometimes provided with grooves on the backs to prevent the thongs from slipping. Exactly the same process was employed until very recently by Central European peasants in the manufacture of toy lead soldiers. Although more complicated valve moulds were in use at a very early period three piece and even four piece none of them has come down to us the castings themselves indicating the method of manufacture. Another method of casting was by the *cire perdue* process (*q.v.*). Edges were put on cutting tools by hammering white-hot and polishing with sand.

**Trade** From points so wide asunder as Denmark and Mesopotamia we find evidence of a lively trade as early as 3000 B.C. Clay tablets engraved with cuneiform inscriptions have been unearthed and these on being deciphered proved to be business letters between bankers and metal brokers. Egyptian records of the same period also refer to metal markets.

Europe at this time was utterly barbarian but nevertheless Ireland had gold England tin and the N. countries amber hence merchants journeyed far and bartered their wares. Then as now the Continent was not a united area and men could not trust each other. As a result of this prototype of modern conditions we find the typical Bronze Age hoards consisting of collections of metal articles deliberately buried. There are four kinds of *domestic* consisting of one each of several different objects all showing signs of having been used and giving proof of the currency of the particular type. *ritual* at the foot of rocks or beside springs suggesting that they were thus sacrificed to a deity and offering no profit.

of utility, *traders'*, containing new and even unfinished articles, together with amber and ingots of unworked metal, *founders'*, consisting of old, broken, and battered specimens, proving that the profession of the "rag, bone, and bottle man" is one of the oldest in the world. These four types of hoards indicate troubled times, just as hoards of Roman coins prove by their date that they were buried during times of war.

*Transport* The age of metal introduced the *wheel* and the *ship*. Primitive Pacific people had travelled im-



Primitive Bronze Axe-head Top, end, and side views

mense distances in dug-out canoes earlier than this, but true ships were not introduced until after metal tools. The Egyptians built fine vessels with cabins and high prows, and their voyages to England and Scandinavia are marked by megalithic tombs.

*Weights and Measures*, and a proto-type of *Heraldry*, were introduced about this time, the former to set a standard in metal values, and the latter, engraved on seals, to enable merchants to "sign" their names by impressing them on documents.

#### TYPES OF BRONZE OBJECTS

*Cells* Axe or adze heads were always used with a wooden haft, into

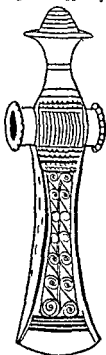
which they were fixed by several different methods. The earliest metal tools so closely resemble the polished stone implements of the Neolithic Age that some authorities maintain that the polished stone blades were copies of the bronze. The earliest form is termed the flat celt, and is simply a wedge of metal, splayed out at the sides by the hammering necessary for putting on the cutting edge. From this simple form development soon took place in the direction of strengthening the blade. This was done by casting a rib longitudinally, a method suggested, no doubt, by the production of an artificial rib during the hammering process. With a stronger blade a reliable method of fixing the head to the haft was required. This was obtained by increasing the height of the rib, so that the "wing" so formed could be hammered into the haft. Later development resulted in a further ridge, and an "ear" through which the leathern thong that fixed head to haft could pass, and finally, after years of slow, almost, it seems at times, reluctant progress, the socketed head, exactly as in use to-day, was produced.

Now that the head was strong in itself, and firmly fixed to the haft, there was no restriction to size and weight, and the double axe was soon forthcoming. This became a cult symbol, and as a result, smaller and weaker double axe-heads were made, not for use, but for purposes akin to decoration, so giving the appearance of a sudden decadence in axe-heads difficult to explain away.

From the double axe we come to the battleaxe, in which one blade is replaced by a knob or spike, and upon which much scroll work was engraved. We here reach the climax of bronze axe development.

*Daggers* The development of the dagger is shown in the provision made to prevent its crumpling up under a heavy blow. The most primitive form is roughly triangular, and almost flat on both faces. Development from

this point presented something of a problem. The blade of a dagger can not be increased greatly in weight without upsetting the balance of the weapon and the triangular blade was forced to be inconveniently stout. Some improvement was made in the



Final development of the Battle-ax

ogival dagger by keeping the sides of the weapon parallel for some distance before tapering to a point in effect a rectangle with a triangle on the narrow side. This was as far as development could go by the open hearth method of smelting but when valve moulds were introduced a much longer rigid blade could be cast by adding a central ridge along the length. This is termed a midrib and greatly increased the penetrating power of the weapon so constructed. Daggers were provided with handles (hilt) of wood, bone, horn or ivory and were joined either by rivets or lashing. In the midrib type of dagger the rib is often carried on above the shoulder to form a tang thus giving a further distinction of "tanged" and "tangless" daggers.

The earliest Egyptian daggers are triangular whilst those from Asia Minor are the tanged midrib type.

**Rapier and sword.** The rapier

seems to have originated in the Aegean. The earliest known was found at Mallia in Crete and is considered to date from 1950 B.C. It is about 3 ft long with a stout midrib. The hilt is of ivory and gold. Development is not traceable for nothing is found until 1600 B.C. when in the shaft graves of Mycenae three distinct types appear.

- (1) A fluted ogival type with tang.
  - (2) A tapering blade with a heavy midrib.
  - (3) A tapering blade with midrib and heavy square flanged butt.
- Later the flange of the third type was lengthened laterally producing the cruciform sword.

The foregoing weapons were designed primarily for thrusting though the later development of type (3) could be swung. A true sword must have more weight in the blade than in the hilt. The earliest swords are of Italian manufacture with the edges nearly parallel and the midrib made broad and flat.

Rapiers and swords were carried in sheaths of wood or leather and such perishable material has not come down to us. We have however the bronze chapes or terminals of which the winged chapes are the most picturesque.

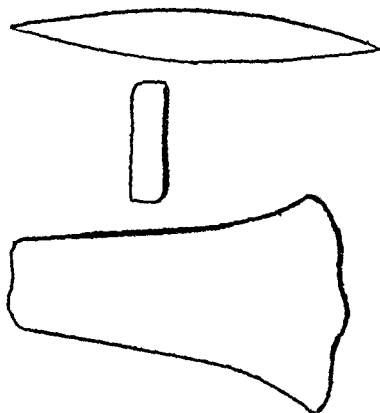
**Halberd.** This weapon is distinctive of the European early Bronze Age and is in essential a triangular dagger set at right angles to a staff. It is considered to have originated in Spain spread from there to Ireland thence to England and Scotland and onward across the North Sea.

**Spear heads.** Although the spear is no doubt the direct descendant of a dagger attached to a pole, spear heads proper are of a distinctive type laurel leaf shape with in the earliest patterns a long strong tang. This type is found in c. 3000 B.C. and from the distinctive shape of the tang is called the poker butted spear head.

On the Greek mainland a new departure was made in the development of a little shoe like fitting into

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They consist of a bronze strip bent double rather wider at the ends than in the middle. In Mesopotamia and India c. 3000 B.C. a different type of tweezer was in use. It consists of two strips of metal brazed together and is rather inclined to be pointed. Being found mounted on rings together with ear scoops and the like these tweezers are regarded as parts of a toilet set and were probably used for removing body lice.

**Sickles** The first sickles were made by fitting flint cutters into a jaw bone and all bronze sickles follow this pattern being curved and sharpened on the inside edge just as the modern tool is.

**Harness** The chief feature of Bronze Age harness is the introduction of the bit the earliest form being a jointed rod much like those in use to-day but unlike modern harness in that it is provided with discs at either end so as to cause the animal pain when the reins were drawn.

**Ornaments** Pins were used at a very early period to fasten clothes. To prevent loss these were provided with a hollow head through which a thread was passed and the varying methods of attaching the thread makes a convenient form of classification.

1 *Roll head pins* were formed by flattening the wire into a riband and rolling this into a little tube.

2. *Racket pins* were formed from the roll head pin by simply widening the plate before rolling.

3 The *disc pin* is the racket pin rolled only half way down with the corners of the resultant rectangle trimmed off.

4 The *wheel pin* was evolved from the disc pin. At first it was simply engraved with a cross and later cast in one piece with the fretwork wheel effect.

5 The *knot headed pin* was produced by bending the cylindrical wire over and twisting it round the shaft of the pin itself.

6 *Toile pins* the earliest of which was found at Hush, dating from 3000

B.C. were formed by beating a section of the pin shaft flat and piercing with a small hole. This flat section some times called the neck is frequently engraved and the top part of the shaft bent over. Some of them were finished off with a bead whilst others were cast with a bulbous or mushroom shaped head.

7 *Sunflower pins* had a flat head bent over to fall in the same plane as the shaft.

8 *Decorative pins* were cast in the form of animals heads or vases in the better kinds and were composed of spiral coils of wire in the less ambitious.

**Safety Pins (Fibulae)** Safety pins make their appearance about 1360 B.C. and strangely enough took two main forms just as do our modern safety pins. The first consisted of one



Bronze Age Safety Pins.

piece of wire bent over to re-engage the point the second two-piece consisted of a shield and pin hinged together (modern brooch form). The former seems to have originated in Italy or Greece the latter in Denmark at opposite ends of the archaic amber trade route and this very opposition suggests an interdependence the one-piece having probably preceded the two-piece and the latter being the result of a clever repair executed so far away from the area of origin. Violin bow fibulae one piece having two more or less parallel sides caught together either by a coil of wire or a flattened area are found largely in Bronze Age deposits in Italy and Sicily. Delicately moved along two lines the first in increasing the cloth gripping power of the pin and the second in decoration. Grippin, power

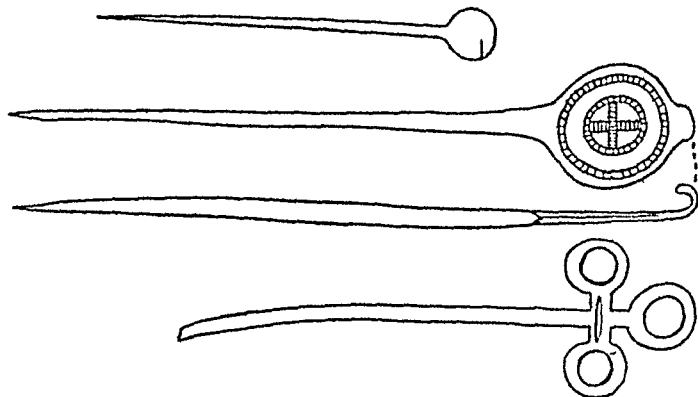
which the spear shaft was slotted, but it was not until the early Minoan type that real strides were made. Reverting to the broad flat tang riveted into a slot in the shaft end, these people developed the tubular socket, by increasing the breadth of the tang and bending the overhanging edges round the staff.

**Arrow-heads** Bronze was too valuable a metal to be commonly used as a projectile weapon, hence, all through the bronze-using periods of the various areas affected, flint and bone arrow-heads were used. Such bronze arrow-heads as we possess were

wooden handle by a line of rivets at the butt. Later, the handle and blade were cast in one piece.

In Great Britain single-edged knives of this period are unknown, but in all probability daggers were used for cutting. Many daggers, *e.g.*, those with a rounded point, could hardly have been used in any other way.

**Razors** Early Bronze Age razors would hardly be recognised as such by either a Sheffield cutler or a London barber, being in form simply a rectangular plate of metal bevelled on all four sides, but even in pre-dynastic times in Egypt a handle was attached



Bronze Age Pins

probably in use during the early Iron Age, when bronze had lost much of its value.

**Knives** The earliest form of metal knife consisted of a strip of copper or bronze, hammered sharp along one edge, and the entire length backed in wood or bone. Although such a tool had most obvious disadvantages, it was not easy to find a method of efficiently securing a blade in line with a handle, and true single-edged knives only make their appearance at a late period. Old-Kingdom Egypt was again first in producing a knife with a long tang in line with the blade. In Europe the problem was solved by using a curved blade, attached to a

by a tang, so that the implement looks like a short, broad, double-edged knife. European razors are very similar, and are provided with a little curved indentation in the tip, the probable function of which was to allow the finger to feel the cheek whilst shaving. This implement developed by the dent becoming deeper and deeper until the razor was divided in two back-to-back blades, with an open-work handle cast in one piece. The Scandinavians dispensed with one blade, thus evolving a razor that may well be regarded as the direct forerunner of our modern implements.

**Tweezers** Depilatory forceps were also used for removing facial hair.

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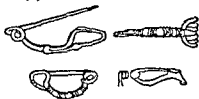
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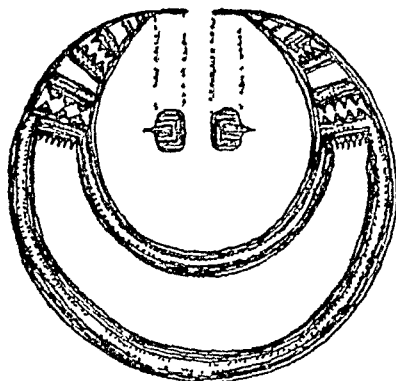


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was given in several ways by lengthening the catch plate, by arching the bow, and by introducing several extra twists in the coil of the spring. The two-piece fibula followed more or less the same lines of modification.



Irish Gold Lunula

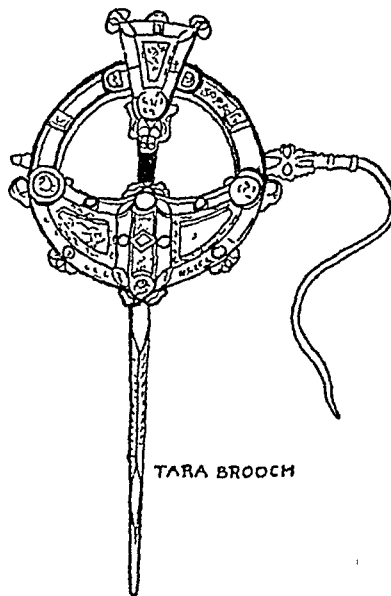
**Bracelets, etc.** The highly civilised people of the Ancient East did not load themselves with heavy rings, but in barbarian Europe this class of personal adornment was common. They consist in the main of bands of bronze, bent into a circle but not closed at the ends. In the early Bronze Age these neck, arm, and leg rings were little better than ingots of metal bent horse-shoe shape. Towards the Middle period engraving appears on the outer side, whilst in the late Bronze Age decorative motifs were cast in the rings, which had tended to become lighter in construction, the solid bar giving place to the ribbon. What the ornaments lost in weight they gained in taste, twisted wire with spiral ends soon coming into fashion, and evolving gradually into quite beautiful forms of spirals and coils. Among this heavy jewellery are included the truly æsthetic Irish *lunula*, crescent-shaped pieces of gold plate pierced and decorated in geometrical designs, and constructed to hang from the neck.

**Finger Rings.** Stone and bone rings were popular long years before metal

was discovered, and, as may be expected, the earliest metal rings were replicas of those constructed from the older materials.

The first move in the direction of utilitarianism in jewellery was made when the seals in current use for marking documents were attached to finger rings. These did not spread into Europe, where the barbarians had no use for them, but they copied the style by producing bronze rings wider at the back than at the front.

**Buttons, etc.** In very early times in the Ancient East, buttons of wood or leather were covered with gold leaf, and much later in Central Europe we find similar button covers of bronze. It is not until the late Bronze Age that we find stout discs of metal provided

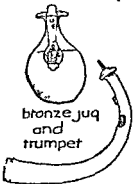


TARA BROOCH

with a shank. Buckles of jet were used in Europe during the early Bronze Age, but when metal became less scarce a hook of twisted wire was used for fastening girdles and the like. Later,

this developed into richly decorated belt plates made from sheet metal with a strong hook rising from the centre. Very fine belt plates and scabbard hooks were worn by the Scandinavian warriors during the middle Bronze Age. Although belts consisting entirely of metal were known the more usual form was leather with metal ornaments attached and all belt plates are perforated round the edge to allow them to be fixed on.

**Earrings** What are perhaps the earliest earrings have been recently unearthed at Ur of the Chaldees. They consist of a wire beaten out curved into a boat shape at one end



bronze jug  
and  
trumpet

and bent into a curve and pointed at the other. This rather beautiful and refined form of decoration was copied and need less to add enlarged in Europe.

**Pendants**  
Early Palaeolithic

man (see ANTHROPOLOGY (CULTURAL)) had worn a charm usually a cowrie shell but sometimes a tooth hanging about his neck and the early Egyptians developed beads from shells, teeth and stone drilled and threaded. The earliest metal pendants are found in this area and take the form of the sacred sun-disk.

**Vessels** Not until metal is plentiful do these make their appearance. The majority of cups and dishes, ewers and cauldrons were beaten from sheet metal but some of convenient size and shape were cast. Spouts were attached by soldering and handles by riveting while rims of vessels were often beaded by hammering a ribband of metal over the edge. No vessels

except two gold cups in Cornwall have been discovered N. of the Alps.

*See also AEGEAN CIVILISATION*

**Bronze Age Ethnology** The whole of the Bronze Age is rich in information concerning cultural movements and migrations of peoples. The early Bronze Age inhabitants of Europe were the same as during the Neolithic period. They were already inextricably mixed in type and the innovation of metallurgical industry must have brought a further influx of foreign blood. However, unification of industry did not result in a united Europe and we find isolated groups remaining isolated, adhering closely to their own styles of pottery and funerary rites and these differences influenced the metal industry. The settled farming people of the coastal areas and fertile valleys were of course the first to adopt the new material; the semi-nomadic people of the interior remaining content with stone implements.

**Central Europe** A group of people in Central Europe belonging to the Aungetitz Culture lived on the great amber trade route. They were mixed with people from Spain (Bell beaker folk) who had affected their industry and outlook considerably and when the second City of Troy was sacked the Aungetitz people developed their own bronze industry. They were a dolichocephalic (see ANTHROPOLOGY (PHYSICAL)) people and buried their dead in a contracted (intrauterine) position. They produced roll-headed knot-headed and perforated pins and made necklaces of amber, bone and bronze beads. Their pottery orange or black is of a very good quality. A distinctive feature of their industry is decorated daggers.

**Italy** Flanged celts were produced in Upper Italy at a period contemporary with the Aungetitz Culture. This was the time of the Italian lake-dwellings and the people are supposed to be invaders from the N. indeed their pottery is rather like the early Aungetitz industry. This area seems to be a meeting-ground of three ethnic

types - an indigenous Neolithic population, invaders from the N., and immigrants from Spain (Bell-beaker pottery people)

*Spain* The S.E. portion of the peninsula is important. Here are found corbelled (see ETHNOLOGY) tombs which are supposed to represent the settlement of Oriental people. The Bronze Age population of Spain was mixed dolichocephalic and brachycephalic. They lived in settlements on hilltops, and defended them with stone walls. The discovery of an altar with horn-like attachments suggests Minoan Crete. Their bronze neck, arm, and finger rings were of light construction, and they made beads of coiled wire and rolled leaf. Their pottery is very closely akin to the Aungmyitz people's.

*Great Britain* The beginning of the Bronze Age in Great Britain is marked by the appearance of "round barrows," beneath which only one person is buried. The Neolithic people had buried their dead in "long barrows" containing several bodies. Bronze implements are only found under round barrows. These Bronze Age invaders were of a brachycephalic type, and probably came from the Rhine area. Their pottery was of the "beaker" type. Decorative motifs vary greatly, and present something of a problem, but it is generally accepted that the beaker people landed in the S. and dispersed gradually N. The invaders did not exterminate the Neolithic people, and though long barrows disappear in favour of round barrows, the Neolithic food vessel occurs in burials as well as the beaker type. The Bronze Age people were semi-nomadic, inasmuch as their occupation of a site rarely if ever exceeded 5 years. Thus their cemeteries are not extensive. Their dwellings consisted of small circular huts, in England cut in the chalk and probably roofed with skins, in Scotland the base consists of stones and turf. Huts of the later period were provided with an exterior elbow-shaped passage, something like the

Eskimo snow hut. The "standing stones" found all over England and Scotland are usually attributed to this period. These ancient monuments are as striking as the Highland and moorland scenery among which they stand. Sometimes they are placed in alignment, but the commoner form is the "stone circle." There is much discussion concerning the function of these, some regarding them as merely tombstones, a point of view suggested by burial mounds being often found at or near the centre of the circle, while others maintain that they were used as temples connected with some astronomical cult. This latter point of view is adopted to explain the existence of the "outlier," a solitary stone standing some distance beyond the circumference of the circle. From the centre of the circle these outliers act like the foresight of a rifle in locating some astronomical body. Frequently the phenomena thus indicated are of a very inconspicuous character, and hardly worthy of attention; however, the burial-mound theory and the temple theory blend comfortably, assuming that some stone circles, Stonehenge for instance, may be purely astronomical, whilst those with burial mounds within may be built in imitation, for a sacred rite, the outlier being intended to indicate, however inexact, the buried person's "lucky star."

*Scandinavia* The N. countries remained content with stone implements much later than Central Europe, but eventually smiths settled in Denmark, and produced a series of bronze objects known as Teutonic. Weapons were buried with the warriors, and from this area we get very fine swords and spear-heads and occasionally battle-axes. Pottery is rare, and such pieces as have come to light have been of very poor quality. Wood vessels were in use, and several cups have been found. Teutonic bronze work displays an artistic feeling in graceful curves, and tasteful curvilinear decoration. Rock carvings in the area demonstrate the use of the wheel, the domestication of the horse,

and a knowledge of music dating back some 2000 B.C. The Teutonic wares were produced for home consumption and only one or two pieces have been discovered abroad. It was not until the late Bronze Age that an export business began.

**Tumulus People** In Holland part of Germany and part of Austria is found a type of grave containing furniture so uniform in style that it is regarded as representative of one culture. These people were of a mixed physical type but are regarded as the descendants of the Neolithic Alpine people and the reason for their being so widely spread is attributed to drought although they were economically a nomadic people and this too must have been at least a contributory cause. Burial places were always marked with a tumulus of earth or stones, the body or bodies being laid on the surface and so covered. In the tumulus graves are found axes, daggers, rapiers, spears and bronze knobs that were originally used to face wooden or lithern shields, finger rings and anklets. The pottery varies considerably over so wide an area but is always graceful and of good quality with tasteful and skilfully moulded designs.

**Terremara** This curious culture is found in Upper Italy. It takes its name from the Terremara settlements, mounds of earth some 15 ft. high and 50 acres in extent usually surrounded by a deep moat. Each mound besides the foundation piles of rows of dwellings contains two burial places which are themselves miniature Terremaras. These burial grounds contain cinerary urns. The inhabitants of the mounds were farmers in the main but they also dabbled in trade. Their bronze goods are celts, chisels, awls, sickles, knives, daggers and swords, razors and combs. The Terremara people are considered as the forbears of the Umbrians, Latins and Sabines.

**Hungary** The most interesting form of bronze manufacture found in Hungary is the axe head with a hole

for the shaft. These were largely exported. Leg and arm ornaments consisted of spirals of bronze ribbon having a wire mid rib which terminated in a coil. They were also fond of pendants which they hung in the hair on the chest and on the back. The Hungarians were distinguished by very fine engraved scroll work on their bronzes, the battle axes being among the best specimens known.

**The Rhône** The bronze industry was a late innovation in the Rhône Valley and shows marks of influence from both the Tumulus people and the Hungarians. However they developed an individual form of broad bronze collars.

**Conclusion** The foregoing rapid survey brings us to the end of the Middle Bronze Age. The late Bronze Age was a period of great unrest in which migrations and cultural infiltrations were so numerous and complicated that no adequate summary can be given. Climatic conditions resulted in a land hunger that led to violent and frequent tribal wars which provided material for the Roman slave trade. Affairs in Asia were also very unsettled and in the Ancient East the Egyptian and Hittite Empires were in constant danger of being overrun by barbarians from the North. The Phœnicians cut off from their supplies of metal ore once more set sail West as they had done in the early period but this time they combined piracy with their legitimate activities, a form of outlawry learned no doubt from Mediterranean land dwellers such as the Sicilians and Sardinians who had been a source of trouble to the Egyptian Empire. It was during the late Bronze Age that Urn fields, cemeteries where the cremated remains of the dead are enshrined in large cinerary urns, became general from Asia Minor to Ireland and a change in funerary rites is always indicative of a deep inner change in the people.

This brings us to about 800 B.C. or the period of Homer when our European ancestors lived in comparative squalor.

and the great civilisations of the east were already at least 5000 years old

**Bronzing** The art of imparting to metals the colouring of bronze. Many lacquers, consisting of finely divided metal suspended in various mediums, are obtainable, but the effect of these can never be closely similar to a metallic surface, since the fine scales of metal reflect the light in all directions. Gun barrels are browned by means of a concentrated solution of butter of antimony (antimony trichloride,  $\text{SbCl}_3$ ). Brass articles may be bronzed by means of a dilute solution of potassium permanganate and sulphate of iron, slightly acidified with hydrochloric acid. By heating the articles afterwards to various temperatures, different colours may be obtained. Another much-used bronzing liquid consists of equal weights of hypo and lead acetate dissolved in water. The lead acetate may be replaced by an equal amount of sulphuric acid, the mixture then giving various shades of red, green, and brown to brass. Zinc may be bronzed by a mixture of 30 parts of sal ammoniac and 10 parts of potassium oxalate dissolved in 1000 parts of vinegar, but the best results are obtained by first plating the zinc with copper by an electric current. Various dark-brown transparent lacquers, generally attained after stoving, are used, including that known as *Florentine bronze*, consisting of cherry gum lac dissolved in alcohol. Bronze articles are given a "patina" by treatment with sal ammoniac and vinegar, to which potassium oxalate may be added. Verdigris may also be employed, together with sal ammoniac and vinegar. To obtain beautiful results with liquids of this kind requires much experience, and frequently a large number of applications.

**Brooch**, or *fibula*, in its original form a bent pin, similar to the modern safety pin, used in various forms by the Greeks, Romans, and Celts. Brooches of the time of the Renaissance were carved and elaborate in shape, set with jewels, and adorned

with pendent pearls. Portrait and mourning brooches with planted hair under glass were a development of the 18th cent., but have now passed out of favour, the brooch to-day existing for the intrinsic beauty with which the modern jeweller's art invests it.

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**Brooklyn**, borough and suburb of New York City on Long Island connected with the main city by a number of fine bridges The waterside which extends for over 30 m is a busy commercial and industrial area The United States Government maintains a navy yard in the district Brooklyn is a thickly populated residential quarter The most striking architectural feature is the white marble city hall Before its incorporation with New York in

1898 Brooklyn was a separate city which had grown out of a Dutch settlement in 1636 In 1776 a battle was fought here between the revolting colonists and the British Pop (1930) 2 560 400

**Broom**, a shrubby member of the family Leguminosae fairly common on sandy heaths The pollen is scattered by an explosive mechanism when an insect alights on the yellow flowers and the seeds are scattered by the sudden bursting of the ripe pods

Several varieties with red and orange and lemon-coloured flowers are cultivated in gardens and a few are favourite greenhouse or hothouse plants They flourish in ordinary garden soil and the common kinds are propagated by seed while choice varieties are grafted or budded on laburnum

**Brougham**, a closed four wheeled carriage drawn by a single horse or

pair originally designed by the 1st Lord Brougham The same design was also used in the early days of motor cars but has become obsolete

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**Brouwer Adrian** (1605-1638) Dutch painter worked at Haarlem as apprentice to Frans Hals and later came under the influence of Rubens at Antwerp His small genre paintings of peasants in tavern scenes have splendid qualities of colour arrangement and form Most of his works are at Dresden and Munich but the Wallace Collection contains one excellent example in his *Sleeping Peasant* and the National Gallery two

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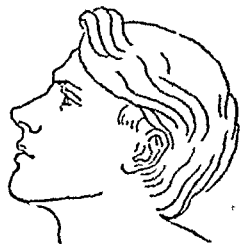
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and biblical subjects. Probably his best-known painting is *Christ washing the Feet of St Peter*, now in the Tate Gallery, London. He decorated the City Hall in Manchester, when, in 12 large paintings, he related the history of the city. One of his daughters, Lucy, married William M. Rossetti, another, Catherine, became the wife of Dr Hueffer and the mother of the writer, Ford Madox Hueffer (now Ford Madox Ford).

**Brown, John** (1800-1859), American abolitionist, settled in Kansas, and became the leader of the anti-slavery movement there, established a central retreat for slaves, 1859, captured and held prominent citizens, was taken by Government troops, convicted of murder, conspiracy, and treason, and hanged, Dec 2, 1859. His fame is enshrined in the well-known song

**Brown, John** (1810-1882), Scots essayist, studied medicine but practised it little. His essays, which were very popular, include *Rab and his Friends*, a tender and humorous animal study.

**Brown, Thos. Edward** (1830-1897), Manx schoolmaster and poet, held many important educational posts, but is remembered best for his poems, which include collections entitled *Fo'c'sle Yarns* (1881), *The Manx Witch* (1889), and *Old John* (1893). He is especially identified with a popular anthology-piece, "A garden is a lovesome thung, God wot."

**Brown Hæmatite**, see IRON AND STEEL

**Browne, Chas. Farrar** ("Artemus Ward") (1834-1867), American humorist, was editor of *Vanity Fair* (1860), where many of his articles appeared. His humour was satirical, and was conveyed in writings of apparent illiteracy and full of misspellings. He lectured throughout America, and, visiting England in 1866, contributed to *Punch*. *Artemus Ward, his Book* (1862) and *Artemus Ward in London* (1867) are two of his many works.

**Browne, Hablot Knight** (1815-1882), English illustrator, better known by

his pseudonym of "Phiz," which he adopted when illustrating the *Pickwick Papers* of Charles Dickens. His pictorial representations of the long series of Dickens's characters have held the public's affection as surely as the works they adorn. He also illustrated Lever and Ainsworth (*qq v*).

**Browne, Robert** (1550-1633), Puritan leader who founded a sect of "Independents," also called "Brownists." He attacked episcopacy and advocated a form of Church government now known as Congregationalism (*q v*). He deserted his earlier opinion to obtain preferment in the Church of England. He died in prison, to which he was committed for striking a parish constable.

**Browne, Sir Thomas** (1605-1682), author and physician, is famed for his *Religio Medici* (published 1642) and *Urn Burial*. They are the writings of a mystic and a Platonist, and their style is rich both in language and thought. Browne was also interested in psychology, and is one of the finest of contemplative writers. His *Pseudodoria Epidemica* (*Vulgar Errors*) may also be mentioned, this is an exposure of popular fallacies which demonstrates both his own wide knowledge and the state of general knowledge in his day.

**Brownian Movement**. The Brownian movement, first described by Robert Brown (1773-1838), an English botanist, consists of a perpetual irregular motion which is to be seen in very small particles of a solid that are suspended in a liquid. The movement is the more vigorous the smaller the particles, and it is only observable under the microscope. It is due to the fact that, as is postulated by the kinetic theory (*q v*), all matter is continually in movement, and in the case of small particles that are immersed in a fluid, the bombardment to which they are subjected by the molecules of the fluid does not, as is the case with larger particles, cancel itself out, with the result that this bombardment gives movement to the suspended matter. Close observations of the Brownian movement have permitted some ex-

remely important theoretical deductions as to the kinetic theory of matter to be experimentally verified

**Browning Elizabeth Barrett** (1806-1861) poetess wife of Robt Browning Throughout her life her poetry was more popular than her husband's The influences of her delicate youth her husband's robust style and of Florence and its associations are all discernible in her work Her best production was the *Sonnets from the Portuguese* her other poems contain faults of over writing and poor rhyming but at her best Mrs Browning is at least the equal of any other English poetess Her *Cry of the Children* (1843) was a notable protest against the conditions then prevalent in factories

**Browning Oscar** (1837-1913) historian was a lecturer at Cambridge where his influence was felt throughout the University His histories deal mostly with Europe during the Revolutionary and Napoleonic periods but he also wrote a history of England

**Browning Robert** (1812-1889) Eng-

lish poet was born in Camberwell London His first publication *Pauline* (1833) he later condemned but in his next works *Paracelsus* (1835) and *Sordello* (1840) his characteristic style



Robert Browning

was seen These are psychological studies of great interest but their obscurity of language and grammatical render them unpopular *Bells and Pomegranates* (1841-1846) a series of pamphlets contained several dramas including *Pippa Passes* and *Dramatic Lyrics* He had already

attempted the dramatic form in *Strafford* (performed 1837) and it now became apparent that the dramatic lyric dealing with some momentary climax of emotion was the best medium for his peculiar genius He married Miss Elizabeth Barrett in 1846 and thereafter lived mostly in Italy *Men and Women* (1855) and *Dramatis Personae* (1864) are perhaps his best productions of this period

His interest in psychology and his power of delineating character are seen at their best in *The Ring and the Book* (1869) and from that time his popularity was more assured The remaining 15 years of his life saw the publication of a vast amount of work mostly in the form of blank verse of a characteristic kind The appreciative *Browning* by G. H. Chesterton is a useful prelude to a study of his poems

**Bruce Hon. Charles Granville**, Brigadier General (b 1866) English soldier and mountaineer leader of Mt Everest expeditions 1902 and 1904

**Bruce James** (1730-1794) explorer and archaeologist and discoverer of the source of the Blue Nile He travelled extensively in W Africa and Syria Much of his success was due to his knowledge of native languages The conclusions he reached were derided at the time but have since been found to be in the main correct

**Bruce, Robert** (1174-1194) King of Scotland national leader against Edward I II and III The Bruce family were descended from a Lord of Annandale who came from Normandy with William the Conqueror Bruce swore fealty to Edward I in 1296 but after vacillating for 6 years rebelled against the English murdered Comyn his rival to the Scottish throne in 1306 and was crowned King of Scotland at Scone Defeated by Pembroke he went into hiding until 1307 when he rallied his forces and easily defended Scotland against Edward II He won the victory of Bannockburn (1314) made incursions into England and secured the right to the Crown of Scotland by the Treaty of Northampton 1328

**Bruce, Stanley Melbourne** (b 1883), Australian statesman. He entered the Australian Parliament in 1918, becoming Treasurer in 1921, under Prime Minister Hughes, whom he succeeded in 1922. As the head of a Coalition Government, Bruce was Prime Minister, Minister of External Affairs, delegate to the Imperial Conferences of 1923 and 1926, Minister of Health (1927-8), and Minister for Territories (1928-9). In 1929, he was defeated, largely through the opposition of Mr Hughes, and succeeded by Mr Scullin. He attended the Ottawa Conference of 1932.

**Bruch, Max** (1838-1920), German composer, is best known for his popular violin concerto in G, but he composed cantatas, symphonies, two other violin concertos, and an opera, *Hermione*. His *Kol Nidrei* for cello and orchestra is also frequently heard.

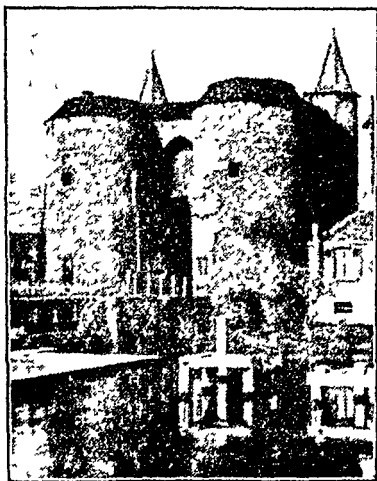
**Brucine**, an alkaloid that is found in the seeds of *nux vomica* and in St Ignatius's beans, together with strychnine, to which it is very closely related. It is somewhat less poisonous than strychnine, medicinally it is not em-

ployed alone, but in the form of tincture of *nux vomica* (which also contains strychnine). It is used to relieve flatulence and stimulate the stomach. The chief active principle of this tincture is, however, strychnine (*qv*), and brucine is merely a component whose action, though similar to that of strychnine, is weaker.

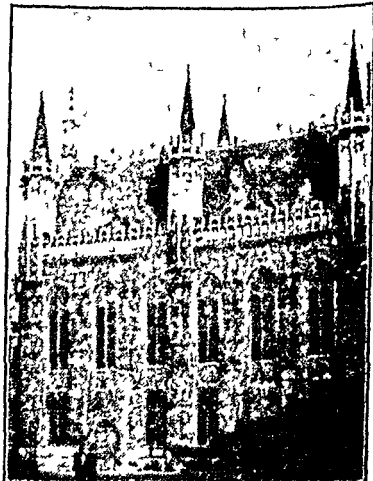
**Bruckner, Anton** (1821-1896), Austrian composer, was organist at Linz Cathedral, and he later became a professor at the Vienna conservatory. In his 8 completed symphonies (the ninth is unfinished), the influence of Beethoven and Wagner is marked. Despite some clumsiness and naivete, Bruckner's music is a strong and impressive expression of its composer's idealism. His symphonies command an increasingly widespread popularity in Germany, though like those of Mahler, who was influenced by him, they are seldom heard in this country. Like Mahler also, he wrote for a large orchestra, including masses and other choral music in his work.

**Brueghel**, see BREUGHEL

**Bruges** [BRŪŌZH] (Flem. *Brugge*), a



Bruges Porte de Gand.



Bruges Hôtel de Ville.

town of W Flanders Belgium with a pop of 51 000 Horticulture and the manufacture of lace are the main industries Its public buildings and churches are particularly fine The Cathedral of St Sauveur is a good specimen of early pointed Gothic In the hospital of St Jean are Memling's best works including the reliquary of St Ursula The 13th-cent belfry famous for its carillon Hôtel de Ville Palais de Justice the Church of St Jacques and the museum are all of special interest Bruges is an ancient city and prior to 1180 was regarded as the capital of Flanders it was occupied by the Germans from 1914 to 1918 and used as a submarine base

**Bruises** (or *Contusions*) are due to bleeding from the small blood vessels under the skin and are caused by a fall or a blow from a blunt instrument The best treatment is the immediate application of tincture of arnica or an ice bag or cold compress If nothing better is available a cold compress can be made from a hand kerchief soaked in a half and half mixture of methylated spirit and water

**Brumaire** [brœmɑ̃ ʁ] the foggy month, the name given to the second month in the French Republican Calendar (1793) corresponding roughly to Nov

**Brummell, Geo Bryan** (1778-1840) (*Beau Brummell*) inherited a fortune while an army captain (1798) led extravagant society life in London was intimate friend of the Prince of Wales (later George IV) quarrelled with him (1813) fled to France in 1816 to avoid creditors made Consul at Caen (1830) and died in poverty in the care of Sisters of Charity

**Brunanburh**, supposed to be the modern Burrowark Dumfriesshire here Athelstan defeated the armies of Aelaf the Dane Owen of Cumberland and Constantine of Scotland (937)

**Brunel** British protected State in N Borneo chief products are wild rubber sago and mangrove extract timber is valuable Native crafts

manship is employed in metal work and domestic weaving The bulk of the inhabitants are Malays or Borneans Chief town Brunes (10 000) There are c 2700 Chinese immigrants Great Britain assumed the protectorate in 1888 and in 1906 the administration of the State under the native ruler Area c 2 000 sq m pop (1931) 30 100

**Brunel, Isambard Kingdom** (1806-18 9) English civil engineer was actively concerned in the construction of the Thames Tunnel and Hungerford Bridge and designed the Clifton Suspension Bridge which was constructed after his death He also designed and constructed large ocean-going steamships and introduced the screw in substitution for paddle wheels He also devoted much attention to improving the design of big guns and constructed the floating battery used in the attacks on Kronstadt in 1854 He was one of the promoters of the Great Exhibition (1851)

**Brunelleschi, Filippo** (1370-1446) Italian architect He designed the dome of the cathedral at Florence as well as the Pitti palace and the churches of San Lorenzo and Santo Spirito in the same city He was a pioneer of Renaissance architecture adapting the ideas of the classical period to the conditions of his day

**Brunhild** [brœnhilt] in Norse mythology the daughter of Odin who for her disobedience was enclosed in a ring of fire until some warrior should pass through it and release her In the *Nibelungenlied* she is represented as the Queen of Iceland who conceived a violent hatred of Siegfried bringing about his death by persuading Hagen to assassinate him She was in her turn killed by Kriemhild Siegfried's wife Historically she was the Queen of Sigbert of Austrasia (561) whom she succeeded as ruler in 573 (d 613)

**Brünn, see BRNO**

**Bruno, St.** (c 1010-1101) founder of the Carthusian (qv) Order was born at Cologne He became Chancellor of the diocese of Rheims but resigned in

1076, and in 1080 resolved to enter the religious life, with 6 companions. In 1084 Bishop Hugh of Grenoble gave the little community the Valley of Chartreuse, where the Grande Chartreuse monastery was founded. Bruno later founded another house of his Order at Squillace, where he died. Feast, Oct 6.

**Brunswick** (Ger *Braunschweig*), formerly a sovereign duchy of N Germany, now a Republic, the new constitution dating from Jan 6, 1922. It covers an area of 1424 sq m, the pop of over 500,000 being largely engaged in mining and agriculture. The main crops cultivated are cereals, sugar-beet, a considerable amount of garden produce, and fruit. The mining and timber industries are centred in the Harz, coal, iron, lead, copper, and salt forming the chief output. The principal exports are thread, dyes, timber, and chemicals. The rivers Oker, Aller, and

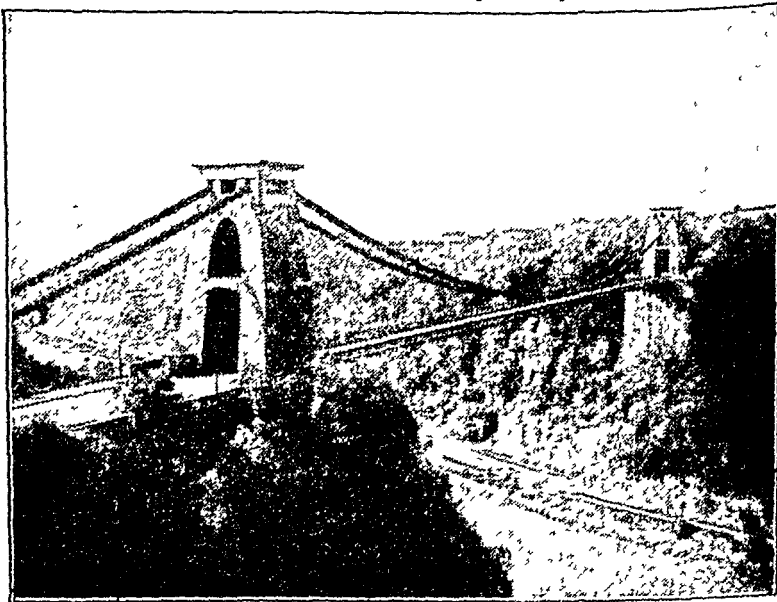
Leine, have their source in the Harz and empty into the Weser.

The Republic is administered by a Diet consisting of 40 members. The population is mainly Lutheran, Roman Catholics ranking next.

Brunswick formed part of Saxony during the reign of Charlemagne, and was inherited by Henry the Proud in 1126. After belonging to various rulers, it was divided into two parts. In 1871 it became a State of the German Empire. Capital, Brunswick, pop 147,000.

**Brunswick Black**, a black pigment obtained from the pitch left as residue after the destructive distillation of bones (see BONE PRODUCTS).

**Brusa** (*Bursa, Broussa, Khudaven-dikhar*), capital of the Turkish vilayet of the same name, situated c 20 m from the Sea of Marmora in NW Anatolia. Chief industries are the weaving of carpets and silk, and the



Brunel's Bridge across the Avon, Clifton

[Courtesy of L M S R]

manufacture of clothing. The modern city is spacious and handsome containing many historic mosques and tombs. The neighbourhood is subject to earthquakes and there are many hot mineral springs. *Brusa* (*Prusa*) was the capital of Bithynia in antiquity and later the metropolis of the Ottomans (until the 17th cent). In 1921 it was the centre of fierce fighting between Turkey and Greece. Pop. (1927) vilayet 401 600 city 61 700.

**Brush Manufacture.** All brushes consist essentially of one or more bundles of more or less springy fibres set in a holder. An enormous variety of fibres are employed the softest being the hair of animals the stiffer brushes employing many kinds of vegetable fibre such as piassava commonly called bass and others known as whisk palmyra bassine cane and wire are also used and whalebone which yields the stiffest and most durable fibres for hair brushes. The bundles of fibres are secured into the holders or handles in various ways such as by cementing with pitch wire staples and so on. Machinery has now been developed for making most kinds of brushes. One type of brush used for a large variety of purposes from pipe cleaning to chimney-sweeping consists of bristles radiating from a core of twisted wire. The finest of soft paint brushes are made from red sable the hairs from the tail of a Russian animal the kolinsky. Commoner and cheaper brushes are made from various qualities of camel and badger hair. For stiffer brushes little are used almost exclusively those of the hog. Vegetable fibres are hardly suitable for use as paint brushes and are confined to the cheapest qualities.

**Brush Turkey.** An Australian turkey-like bird which lays its eggs in a mound of dead leaves where they are hatched by the heat of the sun and the decaying vegetation.

**Brusilov Alexei Alexievich** (1853-1916) Russian soldier commanded during the invasion of E. Galicia in 1915 led the Russian attack in

1916 to assist Italians. Grand Commander of all Russian armies under the Menshevik Government of 1917.

**Brussels** (fr *Bri velles*) capital of Belgium and the province of Brabant situated on the spur of a hill at the base of which flows the Senne a tributary of the Rupel itself an offshoot of the Scheldt. It has now extended its boundaries across the river and up the hillside until it reaches the plateau where there is now the new town of mansions museums hotels and State offices leaving the shop and factories to the lower town.

Of its old buildings those in the Grande Place are the finest. The Hotel de Ville begun in 140 by Van Thienen and completed by Ruystroock in 1454 despite the fact that its two wings disagree architecturally is one of the best examples extant of 15th-cent civic architecture. Opposite stand the *Maison du Roi* rebuilt during the 19th cent. The church of St Gudule and St Michael situated on the slope of the hill begun in the early years of the 13th cent is a good specimen of pointed Gothic rich in stained glass windows that have survived the many bombardments and occupations Brussels has suffered.

The important industries are lace carpets curtains and furniture. There is a university and a military academy not entirely restricted to the Army. The city enjoys a separate administration with a burgomaster sheriffs and council. There is also a British Chamber of Commerce. The history of Brussels is one of repeated change. Capital of the Low Countries in 1547 it came under Alva's rule in 1567 to be heavily bombarded by Villeroi in 1695. Six years later it was taken by the French and in 1704 by Marlborough. Forty years later Saxe and in 1794 Darnour captured it. Finally came the Revolution of 1830-1 when the destiny of the city and country was rendered secure until the World War when it was in German occupation 1914 to 1918. Estimated pop. (1925) 825 000.

**Brussels Conferences:** (1) (1871) A conference to discuss the international laws of war, held at Brussels at the invitation of Russia. Great Britain took no active part, and there were no United States representatives. The conference did not produce any results of importance. (2) (1876) A conference of great Powers summoned by King Leopold of Belgium to discuss the exploitation of Africa. The Congo association was created by this conference (see BERLIN CONFERENCE (1884)). (3) (1890-1900) A conference held to take measures for the suppression of the slave trade in Africa. (4) (1920) A conference of Allied financial experts to discuss the financial problems arising out of the World War.

**Brussels Sprouts** are related to the cabbage and broccoli, but produce an elongated main stem which bears close buds from ground level to top if properly treated. The sprouts should be a good green, moderate-sized, and formed of tightly curled leaves. A succession is obtainable if seed is sown in a frame at the end of Feb. and in the open in March and April.

**Brut**, a legendary hero, grandson of Æneas, who is supposed to have founded New Troy (London) and named Britain. His doings are chronicled by Geoffrey of Monmouth, Wace, and Layamon.

**Brutus**, a Roman family. **LUCIUS JUNIUS**, one of the first Roman consuls, 509 B.C., helped in the expulsion of the Tarquins. **DECIMUS JUNIUS (ALBINUS)** (c. 84-43 B.C.), Governor of Gaul, a prospective successor to Cæsar, was present at Cæsar's assassination, and was killed by Antonius in 43 B.C., after the establishment of the Triumvirate. **MARCUS JUNIUS** (c. 85-42 B.C.), friend of Cæsar and of Cicero, Governor of Cisalpine Gaul, was one of Cæsar's assassins in 44 B.C., he fled with Cassius, was defeated by Antonius and Octavian, and finally committed suicide.

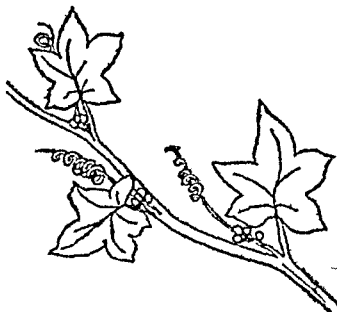
**Bryan, Wm. Jennings** (1860-1925), American politician, barrister 1883, three times defeated in presidential elections of 1896, 1900, and 1908, was

Secretary of State under Wilson, 1913-15, resigning in protest against Wilson's note to Germany concerning the *Lusitania*. Bryan worked for international peace and social reform, and was a brilliant orator. He also gained notoriety as a fundamentalist in religion.

**Bryant, Wm. Cullen** (1794-1878), American poet, was editor of the *New York Evening Post* for 50 years. Bryant was admitted to the bar at 21, but, disliking law, soon forsook it for journalism. His poems include *To a Waterfowl*, *The Death of the Flowers*, and translations in verse of the *Iliad* and *Odyssey*. *Thanatopsis*, written at 18, is considered to mark the beginning of American poetry.

**Bryce, James, 1st Viscount** (1835-1922), British author, politician and diplomat. He had a brilliant career at Oxford, where he won in 1863 the Arnold Historical Essay Prize with *The Holy Roman Empire*—still regarded as a highly valuable text-book. He was British ambassador at Washington 1907-13. His other publications include *The American Commonwealth* (1888), *Modern Democracies* (1921), and *International Relations* (1922).

**Brynmawr**, mining town in Breconshire, situated on high ground near the N. edge of the S. Wales coalfield. The most important occupation is now coal-mining, but iron-smelting was for nearly a century the mainstay of the town. Pop. (1931) 7250.



Bryony

**Bryony** a group of rambling plants represented by the English hedgerow Bryony (*Bryony dioica*) with small greenish flowers red berries and bright



Black Bryony

green leaves. A member of the Yam family *Tamus communis* is called the black bryony having acrid black roots. Bastard bryony is a W Indian vine (*itis sicyodes*)

**Bryozoa**, see POLYZOA

**Brythonic**, a division of the Celtic branch of the Indo European languages which includes Cornish Welsh and Breton

**Bubo** an inflammation of a lymphatic gland. It is the function of these glands to strain the lymph and any germs present are therefore retained and cause inflammation there instead of passing into the blood stream. Treatment includes rest local fomentations light diet and a purge

**Bubonic plague** is a mild form of plague and victims almost always recover

**Buccaneer** a pirate (qv). The name was derived from the boucan a wooden support on which S American natives roast their meat a method

adopted by pirates visiting those coasts

**Buccleuch, Dukes of**, Scottish family descended from Sir Richard le Scott (late 13th cent). Prominent members of the Buccleuch house in Selkirk shire have been Sir Walter Scott (c 1490-1552) mentioned in Scott's *Lay of the Last Minstrel* and famous for his share in the Battle of Pinkie. James Duke of Monmouth 1st Duke of Buccleuch

**Bucephalus** [BŪSĒ FŪLŪS] the horse of Alexander the Great after its death (356 B.C.) its name was given to the town of Bucephala

**Bucer Martin** (1491-1551) Protestant reformer entered the Dominican Order but was converted to the reformed religion by the writings of Luther. He left the Order and devoted his life to propagating the new teaching. In theory a Zwinglian he strove to obtain unity between Lutherans and Zwinglians. In 1548 he opposed the agreement of Augsburg between Catholics and Protestants and took refuge in England where he received the favour of Edward VI

**Buchan John** (b 1875) Scots novel writer won the Newdigate Prize in 1898 has been M.P. for Scottish Universities since 1917 and is a trustee of the National Library of Scotland and of the Pilgrim Trust. His novels include the series *The Thirty nine Steps* (1915) *Greenmantle* (1916) *Mr Standfast* (1919) and *The Three Hostages* (1924). Others are *Presley John* (1910) *Huntingtower* (1912) *Black Wood* (1927) and *Castle Gay* (1930)

**Buchanan, George** (1506-1581) Scots historian and reformer. He took a prominent part in the prosecution of Mary Queen of Scots and was tutor to James VI and Keeper of the Privy Seal. His *History of Scotland* and *De Jure Rebus* (a denial of the divine right of kings) prove him to have been one of the first scholars and profoundest thinkers of his century

**Buchanan, James** (1791-1868) 15th President of the U.S.A. being elected in 1856. His term of office coincided



with certain disputes about the slavery question, the seriousness of which he never appeared to appreciate to the full. He was, however, an excellent administrator.

**Bucharest** (Rum *Bucuresti*), capital of Rumania. A modern city set in a hollow, sometimes called "the Paris of the East." At one period, owing to the frequency of earthquakes, most of the houses were built of wood, but after the accession of Prince Charles, 1866, considerable changes took place, brick, stone, and stucco supplanting wood. Among the chief public buildings are the parliament and palace, the very useful National Library, and the National Theatre. There are many banks, and considerable trade is done in petroleum, wheat, and maize from the Wallachian plains, cabinet-making and distilling. Bucharest is fortified, and the headquarters of an army corps, and has a pop (1930) of 631,000.

**Buchman, Frank** (b 1878), an American clergyman who served in the World War with a flying squadron. He later originated the religious fellowship known as the Oxford Group Movement (*q v*).

**Buchner, Eduard** (1860-1917), German chemist, Professor at Berlin and Breslau, known for his research into fermentation, and the discoverer of the enzymes within yeast cells.

**Bucket Shop**, *see* STOCK EXCHANGE.

**Buckfastleigh**, village of S Devon on the R Dart. On the site of the former Cistercian abbey a community of Benedictines (*q v*) erected Buckfast Abbey in 1882. Pop (1931) 2400.

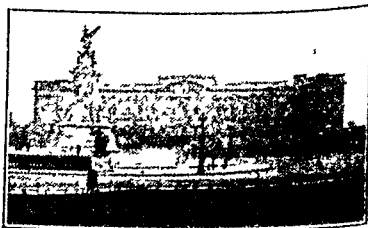
**Buckingham**, former capital of Buckinghamshire, on the Ouse. There are a few old houses, among them the Castle House in West Street, the Old Bull Ring and Market Square. Stowe School is near the town. The St John's Royal Latin School, founded by Edward VI, still exists. Pop (1931) 3082.

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**Buckingham Palace**, London residence of the King of Great Britain. Buckingham House, so called from



Buckingham Palace.

John Sheffield, created Duke of Buckingham in 1703, was erected by him in 1703. George III purchased the house of Sir C Sheffield in 1761 for £21,000, and in 1775 settled it upon Queen Charlotte in lieu of Somerset

House It was then known as Queen's House. The new palace was begun in 1855 Queen Victoria taking possession in 1837. The re-fronting of the palace in Portland stone in 1913 was designed in Renaissance style by Sir Aston Webb this together with the monument which stands before the palace constitutes the Queen Victoria Memorial. Among other State rooms, there is a picture gallery containing many famous works. The grounds behind the palace are more than 40 acres in extent.

**Buckinghamshire** a county in the S Midlands of England bounded by Oxon on the W Northants on the N Berks on the S and by Middlesex Herts and Beds on the E. area 479 360 acres pop 271 565. Its most striking natural feature is the Chiltern Hills to which the warmer and drier climate S of the range is due. The geological features differ widely in character there is Oxford clay estimated to be 400 ft thick beds of Portland stone chalk and a highly fossiliferous limestone. Buckinghamshire is rich in flora and its woods in the N contain oak pine elm maple larch beech is plentiful.

Much land is cultivated wheat and oats forming the principal crops and cattle and sheep are reared. Furture is manufactured at High Wycombe and lace making is a local industry ascribed to Flemish emigrés.

The chief rivers are the Thames Ouse Thame and Ouzel. There are traces of the old Roman or ancient British thoroughfares. It is well served by railway and the Grand Union Canal passes through it. Slough and Wycombe are the largest towns. Among buildings of note are Stowe Chequers Eton College The Claydon and Hampden House. Aylesbury is the county town.

**Buckle Henry Thomas** (1821-1861) English historian. His *History of Civilisation* which he left unfinished is a monumental work but a certain vagueness of conception and a tendency toward allowing personal prejudice to

override facts renders it less valuable than its title would suggest.

**Buckmaster Stanley Owen**, 1st Baron (b 1861) Liberal statesman barrister 1884 K C 160 M P 1906-10 and 1911-15 Appointed Lord Chancellor and raised to the peerage 1915 resigned with Asquith in 1916. He has since taken an active part in law reform movements particularly in regard to divorce and the abolition of the death penalty.

**Buckthorn** (*Rhamnus*) a group of ornamental garden shrubs and trees of easy culture and suited to seaside conditions especially *Rhamnus alaternus variegata* with white mottled leaves. Some species and varieties are evergreen and nearly all are ornamental and berried. The European buckthorn is *P. catharticus* the yellow buckthorn is *R. caudicosa*. An American tree *Bumelia lycioides* is called the Southern buckthorn.

**Bucolics** a general term for pastoral poetry and more particularly for poems purporting to be sung by herdsmen. It is applied to the *Idylls* of Theocritus (qv) the *Eclogues* of Vergil (qv) and later to a collection of poems by Ronsard (qv).

**Budapest**, capital of Hungary on the R Danube. The two parts of the city Buda and Pest are connected by 6 bridges. On the Buda hills stands the Royal Palace with the Mátyás Templon (Matthias Coronation Church) begun in the Romanesque style and completed later in Gothic. During the Turkish occupation (1566 to 1686) this building was used as a mosque. There are Roman remains at Aquincum a ruined amphitheatre and a temple of Mithras and 3 famous baths.

On the opposite bank of the Danube stand the Houses of Parliament the Gothic element predominating though the central feature is a dome. Opposite are the Palace of Justice and the Ministry of Agriculture. In the centre of the city stand the National Museum the Basilica the University Opera House and the

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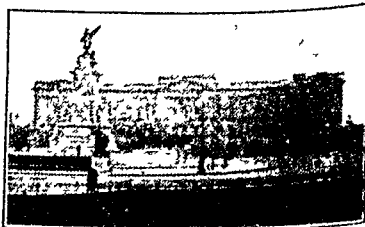
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sensual satisfaction prosperity etc and the Buddha teaches how this pain may be avoided. The third truth shows how the avoidance of pain involves emancipation from these cravings. The fourth truth is the way of the eight fold path to emancipation this is the practical side of the teaching. The eightfold way is by right view right aims right speech right methods of living right effort right mindfulness right conduct and right joy.

Right views are correct ideas concerning these truths and the non-existence of the ego a cardinal point in Buddhist doctrine. Like Plato Buddha taught that rebirth is caused by cravings in this life which have the power to persist without inhering in a subsistent ego by emancipation from these cravings rebirth could be avoided and for this view to be correct it is necessary to deny the existence of the ego. Right effort and right mindfulness involve avoiding one of the great sins stupidity. Right conduct teaches that the disciple of Buddha should cultivate an attitude of love towards others rejoicing in their joy being sad at their grief and regardless of his own gladness and sorrow. The follower of Buddha besides grasping the truths and following the path must free himself from the 10 bonds the intoxications and hindrances before he can reach Arhatship or Nirvana a state of peace and higher wisdom an extinction not of existence but of individuality by merging it in the universal life. This religion held in some form or other by nearly a third of the world's inhabitants in its original form does not mention God or even suppose the existence of a deity. To-day Buddha is worshipped though he never claimed divinity but only to have found enlightenment.

In its pure form Buddhism is an ethical code a way to avoid the pain of individual life and has little of the frequently asserted resemblance to the theistic religion of Christianity. The tenets of Buddhism are in fact an out-

come of the conditions of the times in which Gautama lived.

In the 3rd cent B.C. under the influence of Asoka King of Nagadha Buddhism extended. Missionary efforts spread it over all E. Asia though it gradually lost ground in India except in the far N. The purity of the doctrine became obscured by numerous accretions. Elaborate ritual was practised in its temples and a pantheon of gods came to be believed in. Native religions were incorporated into its practice and its ethical teaching was submerged under a ritual as



Buddha's first warning R. I. C. p.

formal as that against which it itself arose as a protest. With this dissemination of the doctrine and its assimilation of earlier cults differences in Buddhist thought and teaching emerged and schisms occurred.

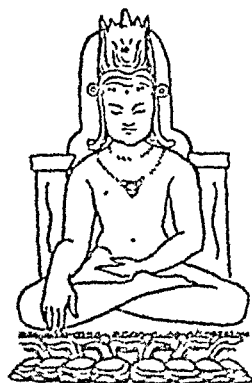
The two main divisions of Buddhism emerging from the schism in the 2nd cent A.D. are the Hinayana or lesser vehicle and the Mahayana or greater vehicle. The Hinayana following in the main the older teaching stresses the duty of the individual to pursue the path laid down by Buddha and to attempt to attain Nirvana. It is a doctrine of agnosticism and stern morality mainly confined to Ceylon

many theatres. In the Városliget (Town Park) is the art gallery. There are large hotels, and an active Bourse. One of the features of social life is the Kavchaz (coffee-house), where wonderful gipsy music may be heard. The pop is over 1,000,000.

**Budaun:** (1) Fertile agricultural district on the Gangetic plain of British India, E. of Delhi. The principal crop is rice, sugar-cane and indigo are also grown. Area c 2000 sq m., pop over 975,000. (2) Town on the R. Sot, capital of (1). It was formerly a vital strategic point to the Moghul dynasty at Delhi. There is a

vast mosque dating from the 13th cent. Pop c 30,000.

**Buddha,** 'the enlightened one,' the name given to Gautama, also known as Siddhartha or Sakya-muni, the founder of the religion now called Buddhism.



Buddha

According to tradition, Gautama was born in the 6th cent. B.C. At the age of 20 he left his wife and child to devote himself to the study of religion. After many years of ascetic life he solved the problem of the suppression of sorrow, and began to preach the doctrines associated with his name. He died at the age of 80.

**Buddhism,** a religion widespread in Burma, China, Japan, Tibet, and Ceylon, deriving its name and essential teachings from Gautama, the Buddha (enlightened one) who lived in the 6th cent. B.C. It arose as a protest against the formal and ritualistic religion then prevalent in India. The mass of cere-

mony that cloaked the Brahman teaching, its exclusiveness and emphasis on caste, the popular and pessimistic belief in transmigration of souls wherein the evils of this life are to be attributed to wrongdoing in a previous life, the internecine warfare of petty Indian States, with their consequent disturbance of traditional faith, were bound to provoke reactions. Two religions arose much about the same time: Jainism, other-worldly and ascetic, and the teaching of Buddha, attempting to find a middle way between this and the worldliness of traditional religion. In spite of the changes in Buddhist doctrine during the ages, in spite of its assimilation of ceremonial and superstition from its predecessors, and in spite of the shifting influences which it has met in its spread over the Far East, the essential teaching has been preserved in what may be something like its original form. It can be roughly summarised thus: *Life is painful because of desire, conquer desire and you conquer pain. Life continues through transmigration because of craving, conquer this craving and the evil of future existence has been conquered.* This is not a doctrine of asceticism or suicide. Asceticism is based on desire, and suicide on a craving for non-existence, both are evil. And therefore Buddha urged his disciples to tread the middle path, leading a life of moderation both in intellect and morals.

In more detail the Buddha taught that there were four truths—"Noble Truths," as he called them. The first is that life is suffering, birth, decay, disease, death, are all painful; the very thing that makes individuality give rise to pain. An individual cannot exist without suffering, as all individuals are limited, and limitation itself involves a necessity of suffering, desire and therefore pain. This does not mean that existence is painful in itself, as is often erroneously supposed. But, as the second truth states, "the suffering comes in an earnest or accompanied by cravings for future life."

**Corwall** The local sand is in considerable demand as a fertiliser owing to its high calcium content. The wild cliff scenery of the adjacent coast is of great beauty. Pop (1931) 3800.

**Budějovice Ceske** (BODOU ZVOVICES) town of Czechoslovakia in the S. of the old kingdom of Bohemia. It is an important rail and distributing centre and a river port at the confluence of the Vltava and Malše. The chief local industries are brewing, woodwork and the manufacture of chemicals, pencils and various clay products. The city was founded in the 13th cent. by Ottocar II the opponent of the Habsburgs. Pop (1930) 43 000.

**Budge** Sir Ernest A. Wallis (b 1857) archaeologist formerly keeper of Egyptian and Assyrian Antiquities at the British Museum. He has conducted many excavations in Mesopotamia and Egypt and has written several books on this subject. He was knighted in 1900.

**Budgerigar** a pretty little grass par

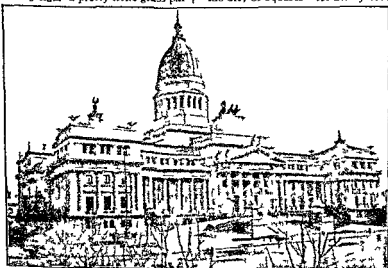
rakeet a native of Australia and well known as a hardy cage bird. There are several varieties yellow green and blue the blue being the most popular.

**Budget** see PUBLIC FINANCE

**Budweis** see BUDĚJOVICE CESKE

**Buenos Aires** capital and chief port of Argentina stands on the Plata R. c 150 m above its mouth. The city occupies an area of 71 sq m and has an estimated pop (193 ) close upon 2 200 000. Although only a river port it has during the past few years grown to great commercial activity new docks costing several million pounds and considerable dredging having removed the former difficulty of anchorage.

Buenos Aires is built on a large grassy plain nearly 80 ft above sea level. It is an attractive progressive city its domestic architecture being of Spanish type with its one storied buildings and patios opening on to the thoroughfare through a wide doorway and its larger buildings reminiscent of French Renaissance. It has been called the City of Squares for nearly 1000



Buenos Aires Government House. La Casa Rosada.

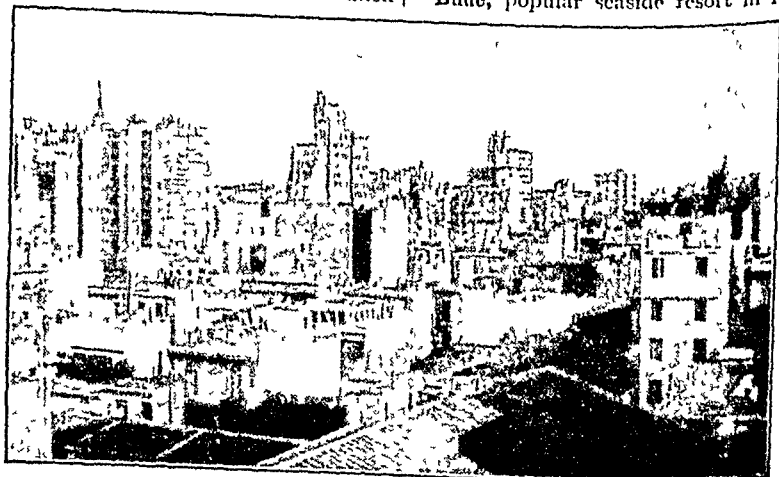
and Burma, and is called Southern Buddhism. The Mahayana, or greater vehicle, teaches that all should aim both at attaining Nirvana and at themselves becoming Buddhas or Saviours. The actual result has been to make the religion easier, not harder, in that followers of the Mahayana are enabled to look for salvation to certain great Buddhist saints. Worship and ritual are essential parts of this branch of Buddhism, which has developed a theistic metaphysic. A further doctrine developed half-way between these two, known sometimes as the Middle Vehicle. Buddhism is no longer an entirely ethical religion; it has come under the influence in various countries of native religious beliefs. The Buddhism of the lesser vehicle differs greatly from that of Tibet, which has assimilated the native Tibetan spirit-worship and its ritual, and again from that of Japan, influenced by Shinto. The differences are as great as those between the Mormons, the Greek Church and the Society of Friends.

**Budding.** A common horticultural practice, to obtain a rapid multiplication, is to graft a bud on to the branch

of another tree or shrub. In the case of seedlings, an earlier production of fruit is brought about than if the bud were left on the parent plant. Delicate kinds are strengthened by being *worked*, as it is called, on more robust stocks. Buds are ready for removal when their bark separates readily from the wood, usually in July or August. Buds from the middle of the shoot should be taken, those from its apex making wood too freely, and those at the base being slow to vegetate. The bud is cut away with a sharp knife a piece of the stem bark being left attached to it, and introduced into a T incision in the stock, and the whole bound with bast. Grafting wax may be used, consisting of sealing wax, 1 part, mutton fat, 1 part, white wax, 1 part, and honey,  $\frac{1}{2}$  part.

**Buddleia** (*Orange-ball Tree*), evergreen shrubs, several of which are hardy, and can be grown in sheltered shrubberies or against a sunny wall, in light, rich soil. The leaves are large and simple, and the flowers borne in long panicles, white, blue, lilac, and purple.

**Bude**, popular seaside resort in N



Buenos Aires Centre of City

combined in a herd

In India where the animal is often called the water buffalo from its fondness for wallowing in morasses the species has been domesticated for generations and was imported into Italy and other countries of S Europe It is used for all the purposes served by ordinary domestic cattle See a' o Bison

**Buffalo Bill** see CODY WM FREDK

**Buffier Claude** see AESTHETICS

**Buffon Georges Louis Leclerc (1707-1788)** French naturalist As head of the *Jardin des Plantes* he studied and wrote his epoch making *Natural History* (1749-1783) the first treatise on evolution in biology and for years the standard work on the subject It was translated into many languages and especially the fifth volume of the supplement *Les Époques de la Nature* (1796) had a decisive influence on biological science

**Bufs**, popular nickname of the East Kent Foot Regiment so-called from the colour of their facings Formed in 1665 of veteran troops who had served in Holland it served again in Flanders under William III under Marlborough and Wellington and in China Sixteen battalions served in the World War

**Bug (bugg)** River of the USSR rising in W Ukraine and flowing SE to the Black Sea which it enters near the efflux of the Dnieper Nikolaev near the head of the estuary is the principal town on the river It is navigable only in the estuary Length c 450 m ( ) Riv r of Poland a tributary of the Vistula which it joins c 60 m below Warsaw It rises in Galicia and flows in a general direction NW The principal town on its banks is Brest Litovsk whence it is navigable to its confluence with the Vistula Length c 500 m

**Buggy** a light horse-carriage of Indian origin with 2 wheels (in England and India) or 4 (in the USA) and hooded (in India and the USA) or unhooded (in England) One type has been perfected for speed and is used in trotting races.

**Bugle** (1) A copper wind instrument without valves used in the Army for sounding signals to convey orders to the troops It is usually tuned either in B flat or C It is a tube bent in upon itself several times and broadening out in a flare Brass is sometimes used with copper in its manufacture (2) A glass or jet ornament which was a favourite Victorian dress decoration

**Bugle (bot)** see AJUCA

**Bugs** insects of the order *Hemiptera* related to the bed bug to which the term was formerly restricted They have piercing jaws a gullet adapted for sucking and typically two pairs of wings the upper pair being partly horny Bugs live mostly on plant sucking their juices but many such as the water boatman and water scorpion are aquatic

The bed bug is found in dirty houses sheltering in crannies by day and coming out at night to suck the blood of sleeping human being In N America the term bug is loosely applied to many forms of insect

See also INSECTS PARASITISM

**Buhl (bööL)** the name given to a method of decorating furniture by inlaying brass or silver into a surface of tortoise shell or wood The process was invented by and named after André Boulle in the 17th cent but the English spelling has come to be that given above Buhl furniture was very popular in France but was not much used in England although Sheraton and his contemporaries occasionally resorted to it It is frequently seen on rather elaborate and ornamental clocks

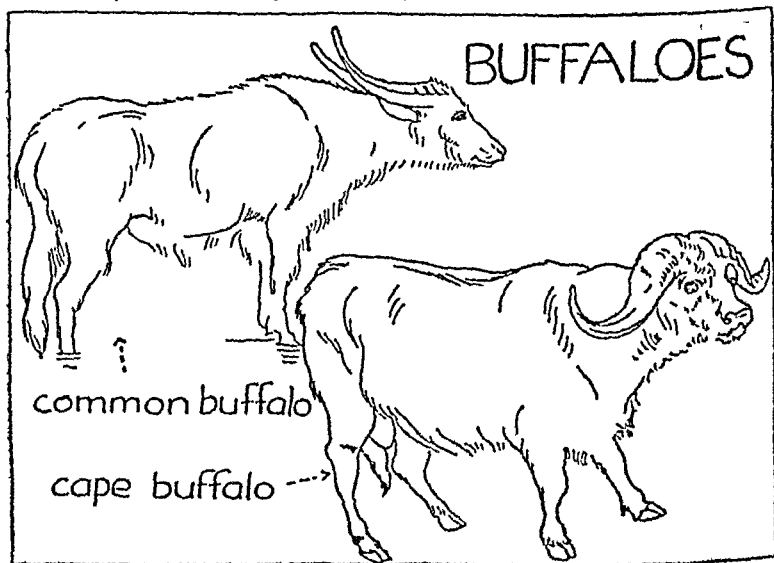
**Buhrstone Mill** see CRUSHING AND GRINDING

**Building** From the earliest times one of man's chief preoccupations has been building Arising in the first place from the necessity for providing shelter from the elements the art of building has passed through many stages from the simple sheltered hut to the mighty skyscrapers of New York Underlying all this apparent



acres are now devoted to plazas and squares in the city. Some of the avenues, such as the Avenida Alvear and Avenida de Mayo are superb. The cathedral is one of the largest in S America and is not unlike the Madeleine in Paris. There are churches, theatres, a fine opera-house, an imposing Government House, a Congress Hall, and a Municipal Hall, the Argentine Social Museum for the study of problems affecting the city and country, and a huge central

timber, coal, and live stock. Flour-milling, shipbuilding, iron and steel manufactures, distilling, brewing and meat packing are the chief industries. A bridge, completed in 1927, communicates with Fort Erie in Canada. The Niagara Falls are the chief source of electric power in the city. The early settlement at Buffalo was almost destroyed by the British in 1813; the modern town grew up in the second decade of the 19th century. Pop (1930) 573,100.



market. The city is administered by a Mayor and Council, and kept in order by a police force military in character but controlled by the Council. Railways, trams, and postal system are well regulated.

**Buenzas**, see PIRENNE

**Buffalo**, lake port and second largest city of New York State, U.S.A., situated on the E. shore of Lake Erie, 120 m. N. of New York City. It is a very important trading and railway centre, and a municipal air-port. The staple articles of trade are grain,

**Buffalo**, large wild cattle, mostly black in colour, with massive horns and a short scanty coat. They are represented by two well-defined species, inhabiting Africa and Asia respectively. The African buffalo is considered by sportsmen one of the most dangerous animals to interfere with. Two or three lions will sometimes combine to kill one, but a bull is more than a match for a single lion. The same is true of the Indian buffalo, which a tiger seldom ventures to attack. They are particularly formidable when

tion supported on simple forms of truss. The desire for fire protection led to the use of stone vaults with a pointed timber roof superimposed. Roofs were covered with slates, tiles or lead. In many cases, however, open timber roofs were used and much ingenuity was shown in the design of the trusses. A fine example of the hammer beam type may be seen at Westminster Hall.

With the Renaissance there came a general reversion to Classical ideas and the trabeated style was reintroduced in elevational design though not always in construction. With the building of St. Paul's Cathedral by Wren the foundations of the modern theory of structures and building construction were laid. Further epoch-making events were the introduction of steel, the invention of Portland cement and the opening of the Stockton to Darlington railway in 1825. The latter event gave a great impetus to the design of bridges and the mathematical investigation of stresses and strains and the properties of materials.

The most striking characteristics of modern building construction are the parts played by steel and concrete. In ordinary domestic work these two materials are not met with to any great extent, an occasional steel joist or concrete floor is used and as yet the number of all-concrete houses is in England comparatively small. In factory and commercial buildings, however, steel and concrete are used in large quantities. In domestic work, the walls are usually of brick 9 in. or 14 in. thick. Sometimes hollow wall construction is adopted in which there is an outer skin  $4\frac{1}{2}$  in. thick, then a 2 in. cavity and then a 9 in. or 14 in. wall. The outer skin must be tied to the inner wall with galvanized steel ties at frequent intervals. Hollow walls have valuable insulating properties and are useful in the prevention of dampness on the inner surfaces of the walls. It is essential that the cavity should be ventilated and at the same time made

vermin proof. Floors are usually of timber in the living rooms and concrete or tiles on concrete in bathrooms, kitchens and sculleries. Few houses are now without proper sanitation. Drains must not pass under the house and must be fitted with inspection chambers and intercepting traps before connection is made with the main sewer. Windows are made either with wooden frames or with steel frames. The use of the latter is being greatly extended, the standardisation of sizes and the weather-resisting properties are obvious advantages. Roofs are of slates or tiles.

In the case of large steel framed or concrete buildings in which considerable loads are to be expected, great attention must be paid to the foundations. In New York there is a substratum of rock at no great depth and this enables the huge skyscrapers to be founded without difficulty. In London the subsoil consists of gravels and clays and foundations consequently require careful designing. A foundation is essentially a means whereby the load on a wall or column is transmitted to the ground over a large area compared with the cross-section of the wall or column. In bad ground or where a number of columns are spaced close together, it is usual to adopt a raft foundation. This consists of a bed or raft of concrete of suitable thickness and reinforced with steel bars or wire mesh to prevent cracking. Where steel columns are used, some suitable means must be provided for joining the column to the foundation. Usually a steel plate is fastened to the end of the column by means of angle irons and the base plate in turn is secured to the concrete by rag bolts which are grouted in. In reinforced-concrete columns the reinforcement in the columns is carried down into the foundation and column and foundation are poured together to form a monolithic mass. Water must be excluded from foundations whilst digging or pouring is in process and it may be necessary to surround the site of the

diversity of construction there are but three distinct principles, that of the post and lintel, that of the arch and abutment, and that of the framed structure. The history of building may be divided very broadly into three periods (1) from the dawn of history to the time of the Romans, when the post and lintel method of construction was in general use, (2) favouring the use of the arch and abutment, continuing to the middle of the 16th cent., (3) covering the remaining centuries to modern times, in which the first two principles are combined with the new principle of the frame.

The earliest building materials were timber, mud, and reeds for thatching. With the desire for permanency, the walls of buildings came to be constructed of stone, first of stones piled roughly on top of one another, and then, as tools and methods improved, of squared stones fitting closely together. In Egypt the art of stone-cutting had reached a high state of perfection 4000 years before Christian times, and in many examples of Egyptian work still in existence the joints are so close and fine as to be hardly discernible. The Egyptians were not only masters of the separate crafts, they also had a high understanding of constructional methods, quarrying, and transport of materials and the control of labour. The actual method adopted for the construction of the Pyramids is still uncertain, but it is obvious that vast numbers of men must have been employed to raise the gigantic stones into position. From certain remains at Karnak it appears as if inclined approaches were used on which to haul large blocks to elevated positions, and possibly this method was adopted for the Pyramids.

The Pyramids are constructed of limestone blocks throughout, with the exception of the internal passages, which are lined with granite. These granite blocks are dovetailed together with a degree of excellence which it would be impossible to excel even at the present time. The exterior faces

of the Pyramids were originally cased with alabaster, presenting a perfectly smooth surface, this has now mostly disappeared, leaving the familiar stepped appearance. Egyptian buildings were roofed with flat stones, the usual practice being to leave the central portion of the building roofless. Columns were at first square, later developing to the cylindrical form with inverted bell-shaped capitals. Walls were of great thickness, perhaps as much as 10 ft, usually of stone facing with brick or rubble filling. So far as constructional principles are concerned no great advance in building was made until Roman times. The Assyrian built largely of mud bricks, and used bronze and stone doors hung on hinges. The Persians employed timber to a certain extent in roof construction, resulting in a lighter roof, which permitted of the columns being spaced at greater intervals than was common in Egyptian building. Grecian columns were usually fluted and made up of sections dowelled into one another.

With the Roman era the second great principle of construction was evolved. The Romans thoroughly understood the use of the arch, the necessity for abutments, and the various means of balancing thrusts. In building vaults and domes they combined the use of the arch with the use of concrete. The vault ribs were constructed of stonework, and the intervening spaces were filled with concrete. Roman concrete was a mixture of lime and pozzuolana, a siliceous volcanic deposit found near Rome. The use of the round arch continued throughout the first 10 cent. of the Christian era, but it was not until the Gothic period that the pointed arch came into general use. The pointed arch arose from the difficulty of roofing wide spans with the round arch; it is safer and more stable over a large span. It was introduced into England in c. A.D. 1119.

Roofs, in mediæval times, were at first of open timber construction.

series of ribs of ordinary reinforced concrete the intervening spaces being filled with light weight concrete reinforced with wire mesh. The thickness of such a roof may not exceed 2 or 3 in. Concrete floors are generally finished with a rendering which may take the form of a layer of fine concrete 1 in. thick. A common rendering is that termed granolithic in which the aggregate consists of fine granite chippings. Renderings are either laid after the floor itself has set and hardened or may be laid directly on top of the wet concrete floor. The surface of a rendered floor while still wet is generally brought up smooth with a steel trowel the process being known as floating. Floors in factories and garages where chemicals and oils are likely to cause disintegration require special treatment. Roofs consisting of a flat slab of sound concrete theoretically require no weatherproofing. It is usually the custom however to apply a protective coating in the form of a tarred roofing felt or a layer of asphalt. In reinforced concrete work the timber shuttering or moulds for the wet concrete is always an expensive item and one which needs careful attention. Metal shuttering is employed to a certain extent but its use is naturally limited to certain standard forms. Concretes may be coloured by the addition of certain materials and surface effects may be obtained by treating the inside of the shuttering with chemicals or by chipping the hardened surface after the shuttering has been removed.

In steel frame construction all loads whether of floors or of walls are transmitted by the horizontal beams to the stanchions and thence to the foundations. It is usual to erect the steel framework first then to lay the floors and finally to bring up the walls and outside casing. Floors are of two main kinds they may be of flat reinforced concrete slabs resting on the beams or they may be made up of a number of long hollow reinforced tiles spanning between the beams. The

advantage of the latter method is its lightness and consequent reduction in the load. Although steel frame construction may at first sight appear practically fireproof yet it has to be remembered that if a steel structure is subjected to great heat the expansion of the various members will be such as to distort and crumple the whole structure into an almost unrecognisable mass. Steel stanchions and beams are therefore always enclosed in brickwork stonework or concrete so as to reduce the possibilities of expansion in the event of exposure to heat. Walls in steel frame buildings are generally of brickwork and are faced with stonework or better-class bricks. Cast concrete walls are occasionally used. In all buildings where large quantities of concrete are used careful attention must be paid to the grading mixing and distribution of the concrete. The sizes of the aggregate and the proportions of the mix must be carefully regulated so as to produce a concrete of the maximum density. On undertakings of any size the concrete is mixed mechanically at a central point is then conveyed to the top of a steel lattice tower from which it is poured into shoots which distribute it wherever it is required.

Building construction is governed in London by the London Building Act and by various other by laws in most parts of the country. The object of the Act is not to control or influence design but to ensure that certain standard in respect of safe loading sanitary conditions and fire protection are maintained. Before any building can be erected in London detailed plans of the proposals must be submitted to the authority for approval and as the works proceed they are liable to be visited by officials of the authority whose duty it is to see that the work is carried out according to the approved plans. See also ARCHITECTURE.

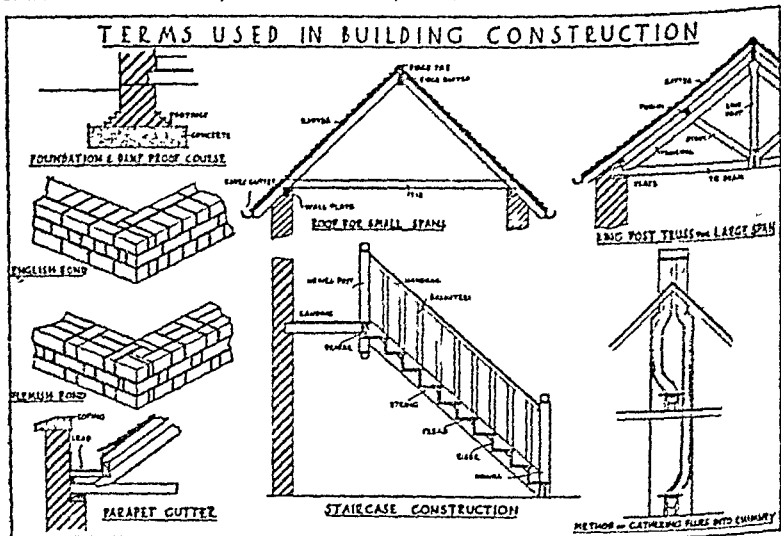
Building Societies, originally small bodies of people who co-operatively undertook house building and pur-

digging with sheet piling and to keep pumps working continuously

Reinforced concrete is concrete strengthened with steel bars embedded within it. Plain concrete is strong in compression but weak in tension, and steel is therefore introduced in such a way that it will take the tensile stresses only, leaving the concrete to take the compressive stresses. Thus, in the case of a simple beam supported at both ends and loaded at the centre, the steel bars

form of a continuous spiral, known technically as helical binding. The function of the binding is to keep the bars in their relative positions during pouring of the concrete and to act as reinforcement to resist bulging stresses.

Two forms of floor construction are common in reinforced concrete work, the beam and slab system, and the mushroom system. In the first the floor consists of a series of rectangular slabs, supported along the edges by beams. The beams in turn are sup-



would be embedded in the beam near the lower surface, where tension obviously will occur. In concrete floors reinforcement is laid in two directions at right angles, and many forms of steel wire mesh are now marketed to save the labour of arranging countless numbers of small bars. Concrete columns are of various sections, square, multi-sided, and round, and are provided with vertical steel rods to act as reinforcement. The bars are bound round at intervals with thin steel rods, termed hoops. In the case of round columns the building often takes the

form of a continuous spiral, known technically as helical binding. The function of the binding is to keep the bars in their relative positions during pouring of the concrete and to act as reinforcement to resist bulging stresses. Two forms of floor construction are common in reinforced concrete work, the beam and slab system, and the mushroom system. In the first the floor consists of a series of rectangular slabs, supported along the edges by beams. The beams in turn are supported on square columns. Floor slabs, beams, and columns are all monolithic. In the mushroom system the columns are generally round, and are flattened out at the top into inverted cones. The floor slabs are supported on the cones, and beams are dispensed with. The mushroom system is of advantage where the maximum headroom is required. A certain amount of work is now being carried out, especially on the Continent, with light-weight pumice concrete. Domes and barrel vaults constructed on this system consist of a

10 millions which aggregate more than half the total for the whole country

Buitenzorg, town in Java 900 ft above the sea S of Batavia Dutch E Indies residence of the Governor General The climate is very agreeable to Europeans Buitenzorg is the capital of a Residency and celebrated for its remarkably well-equipped botanical gardens Pop (19 6) town 47 000 residency 887 000

Bukovina, formerly an Austrian crown-land transferred to Rumania on Nov 28 1918 In area it is 4030 sq m and has a pop of 846 000 (1930) composed mainly of Ruthenians and Rumanians It lies in the extreme N of Rumania Apart from the Dniester which traverses the N border Bukovina belongs to the Danube watershed Other rivers are the Pruth Sereth Moldava and Iltz The winters are severe but the climate cannot be called unhealthy Salt is the only mineral rich deposit being found at Kaczka Nearly half the area is woodland the beech being very abundant Apart from the cultivation of wheat, maize oats and barley some trade in brewing and distilling is done commerce being almost exclusively in the hands of the Armenians and Jews

Educationally Bukovina is not advanced there being a large number of illiterates There are no important towns Cernautz (Ger Czernowitz) the capital has a pop (1930) of 111 000 and is the seat of a University Originally Bukovina was a part of Moldavia ceded to Austria by the Treaty of 17 Later it was incorporated with Galicia but separated in 1949 to become an Austrian crown land

Bulawayo, largest town of S Rhodesia, 14 0 m. from Cape Town an important market and railway centre Lobengula the chief of the Matabele had his principal kraal on the site of the first British settlement the modern town is a few miles away Flowering days are commemorated by a statue to Cecil Rhodes and the

Matabele War Memorial Pop 31 000 (11 800 Europeans)

Bulb (bot) an underground bud with scales The scales represent either whole leaves or leaf bases In the former case they are fleshy or dry according to their function of food storage or protection and ordinary foliage leaves are formed and grow above ground through the favourable season and then die immediately In the second case the foliage leaves break off and leave the bases to serve as protective organs and food reserves during the unfavourable period of the year and to nurture the young bud

Typical bulbs are those of the tulip hyacinth onion and lily The underground organs sold as bulbs of crocus are not bulbs in the strict sense but corms since the reserve food is stored in an enlarged and flattened stem

*Bulbs for Indoor Decoration*—

Hyacinths are the favourites for pin flowering indoors at a time when few other flowers are available By careful attention flowers may be obtained right through the spring from very early weeks Christmas blooms are raised only by rapid forcing in heat but by ordinary methods flowering can be induced in the last weeks of January Heavy bulbs should be selected of good symmetrical shape free from any trace of disease and covered with fine-textured and well coloured scales Bulb fibre or ordinary soil may be used The latter should be sterilised by pouring boiling water on it or by heating in an oven to destroy all trace of pest which might harm the bulbs The fibre or soil should then be thoroughly lapped and allowed to drain and placed in the pots on a layer of well broken bricks or other porous material A firm base should be made and covered with a little powdered charcoal and sand and the bulb placed upon it and firmly covered with soil to its neck It is a frequent mistake to grow bulbs in large pots they tend to rot better in rather than flowers The bulbs should be

chase, they have gradually developed into a specialised form of bank with limited powers. In 1781, a society was formed in Birmingham to undertake new building operations, each subscriber of one share being entitled to have a house built worth £70. Building Societies were recognised under the Friendly Societies Act (1834) and under a special Act of 1836. By 1850 there were 2000 of them, but the majority were terminating societies, i.e. they ceased to function when all the members had been served. About 1846, an increase in the number of investing members led to experiments in permanent management. Here the activities of the societies divided into two—on the one hand they promoted saving, on the other they facilitated house-purchase with the money saved. An act of 1874 limited the liability of members to arrears of mortgage, arranged for the incorporation of all new societies, granted limited powers of borrowing, and pointed the way to modern development. A further Act of 1894 removed other abuses and tightened up regulations following the failure of the Liberator in 1892. By 1913 the total assets of building societies were £65 millions and their membership over 600,000.

Building societies raise their funds from shareholders and depositors, and lend them out for the purpose of (a) purchasing houses, (b) building houses, or (c) paying off existing mortgages. The difference between the interest rates received and paid supplies working costs as in the case of banks. Shares, which pay interest of 3½ or 4 per cent free of income-tax are only dealt with through the societies, and always stand at par. On an average about 1 per cent more is charged to borrowers, i.e. 4½–5 per cent.

The borrower undertakes to repay the mortgage in monthly or quarterly sums of principal and interest. These payments are little higher than normal rent and in 10 or 20 years the property remains unencumbered in his hands. Normally the building societies

advance 75–80 per cent of the property value, the remainder being regarded as the borrower's deposit. There are schemes whereby he may clear off the whole mortgage on selling the property, and others whereby the outstanding mortgage is wholly remitted in case of death.

Building societies are supervised by the Chief Registrar of Friendly Societies, and are controlled by their own general meetings. A National Association of Building Societies was founded in 1869, and affiliates 365 important societies. The movement has grown most successfully in the U.S.A., where in 1930 there were 11,777 building and loan associations, with a membership of 12–13 millions, and assets of \$8828 millions. S. Africa (£25 millions assets), New Zealand (£8 millions), Germany (since 1924) and Austria have been other fruitful fields. The following are figures for Great Britain for 1931.

No. of societies	1,013
Share investors	1,577,905
Borrowers	802,331
Total members	2,380,439
Depositors	465,150
Total receipts	£169,621,338
Advances on mortgage	£90,233,123
Total mortgage assets	£160,176,659
Total other assets	£68,008,211
Total assets	£228,184,870
Total undivided profit	£20,051,058
Total liabilities to shareholders	£311,791,618
Total liabilities to depositors and others	£67,338,864

## DEVELOPMENT (1890–1931)

Year	Societies	Members (thousands)	Total assets (million £s.)
1890	2378	615	51
1900	2238	695	70
1910	1640	626	76
1915	1451	626	75
1920	1276	748	87
1925	1098	1120	169
1930	1026	2170	371
1931	1013	2390	419

There is a tendency towards amalgamation of societies, and to-day about 10 have each assets of over

ties than any other animal goats pigs donkeys mules and cattle are also found in considerable numbers

Industry is not well developed and efforts are being made by the Government to stimulate it Bulgaria is rich in coal other minerals are copper zinc lead lead-copper aluminium and salt The principal imports are textiles metals oils and fats skins resin mineral salts and machinery their largest exports being tobacco with attar of roses maize eggs cocoons and sugar

The legislative power is vested in the King and the Sobranie or assembly elected for 4 years by manhood suffrage The internal government of the 2 departments is controlled by the Minister of the Interior There are many towns of more than 20 000 inhabitants the 4 largest being Sofia the capital with 213 000 Philippopolis 85 000 Varna a Black Sea port 60 000 and Rustchuk on the Danube 46 000 There are consular representatives at Sofia Varna and Burgas The mercantile marine is small but the Black Sea port trades and shipping on the Danube are steadily increasing nearly 20 000 vessels entering annually There are 1573 m of standard gauge railway and 85 of narrow gauge Under the Treaty of Neuilly the Army must not exceed 90 000 raised under a voluntary system No naval or military aircraft is permitted The Navy is restricted to 4 torpedo-boats without torpedoes and 8 motor boats for use on the Danube

The two mountain chains the Balkans and Rhodope are the most striking physical features This mountain system provides the country with 3 main watersheds The bulk of the water drains N into the Danube on its way to the Black Sea and S into the Maritza In the N are the E Lom of commercial and strategic value to Rustchuk the Yantra Iskar Vid and Ossem The S rivers are important the Maritza with its tributaries the Tunja and Arda and the Struma

A feature of Bulgaria is the number

of passes one of which the Shipka made history during the Russo-Turkish War 1877-78 others are the Demir Kapu Dobral Tröian and Dragoman

The climate is treacherous and severe with extremes of heat and cold the low swampy ground in the vicinity of the Danube is very unhealthy in summer

There are few special features in Bulgarian fauna The small brown bear abound in the mountainous districts there are many wolves jackals lynx wild cat wild boar polecat The domestic animals are similar to those of the other Near Eastern countries The birds of Bulgaria are interesting but not unusual eagles vultures and kites are plentiful the red startling and the spotted cuckoo providing a variation In the Danube sturgeon carp and sterlet are found and the Black Sea provides turbot and mackerel

Education is free and obligatory from 7 to 14 years there are many schools and a well equipped University at Sofia

The majority of the population are members of the Orthodox Bulgarian National Church which was declared by the Greek Patriarch at Constantinople in 1870 to be outside the Orthodox Communion

Early Bulgarian history is a series of contests with Byzantine Emperors During the First Empire the outstanding figure was Tsar Simeon who raised Bulgaria to a position of power among civilised people but at his death decline set in In the second Empire Tsar Ivan Asen II (1185-1195) regarded as the greatest of all Bulgarian rulers restored the glory of the kingdom only to be followed by a period of decay and for a time Bulgaria became subject to Serbia under Stefan Dushan But the dark period was the 5 cents under the rule of the Turks ending in 1878 when a National Revival began The ill-fated advent of Prince Alexander of Battenberg Bulgaria's first modern ruler and



chase, they have gradually developed into a specialised form of bank with limited powers. In 1781, a society was formed in Birmingham to undertake new building operations, each subscriber of one share being entitled to have a house built worth £70. Building Societies were recognised under the Friendly Societies Act (1834) and under a special Act of 1836. By 1850 there were 2000 of them, but the majority were terminating societies, i.e. they ceased to function when all the members had been served. About 1846, an increase in the number of investing members led to experiments in permanent management. Here the activities of the societies divided into two—on the one hand they promoted saving, on the other they facilitated house-purchase with the money saved. An act of 1874 limited the liability of members to arrears of mortgage, arranged for the incorporation of all new societies, granted limited powers of borrowing, and pointed the way to modern development. A further Act of 1894 removed other abuses and tightened up regulations following the failure of the Liberator in 1892. By 1913 the total assets of building societies were £65 millions and their membership over 600,000.

Building societies raise their funds from shareholders and depositors, and lend them out for the purpose of (a) purchasing houses, (b) building houses, or (c) paying off existing mortgages. The difference between the interest rates received and paid supplies working costs as in the case of banks. Shares which pay interest of  $3\frac{1}{2}$  or 4 per cent free of income-tax, are only dealt with through the societies, and always stand at par. On an average, about 1 per cent more is charged to borrowers, i.e.  $4\frac{1}{2}$ –5 per cent.

The borrower undertakes to repay the mortgage in monthly or quarterly sums of principal and interest. These payments are little higher than normal rent, and in 10 or 20 years the property remains unencumbered in his hands. Normally, the building societies

advance 75–80 per cent of the property value, the remainder being regarded as the borrower's deposit. There are schemes whereby he may clear off the whole mortgage on selling the property, and others whereby the outstanding mortgage is wholly remitted in case of death.

Building societies are supervised by the Chief Registrar of Friendly Societies, and are controlled by their own general meetings. A National Association of Building Societies was founded in 1869, and affiliates 355 important societies. The movement has grown most successfully in the U.S.A., where in 1930 there were 11,777 building and loan associations, with a membership of 12–13 millions, and assets of \$8828 millions. In Africa (£25 millions assets), New Zealand (£8 millions), Germany (since 1924) and Austria have been other fruitful fields. The following are figures for Great Britain for 1931.

No. of societies	1,577,965
Share investors	802,531
Borrowers	2,240,479
Total members	463,163
Depositors	163,621,938
Total receipts	£99,228,123
Advances on mortgage	£360,176,803
Total mortgage assets	£69,004,611
Total other assets	£419,185,370
Total assets	£20,951,885
Total undivided profit	£311,794,618
Total liabilities to shareholders and others	£57,338,864

## DEVELOPMENT (1890–1931)

Year	Societies	Members (thousands)	Total assets (million £)
1890	2378	615	51
1900	2238	685	76
1910	1690	626	65
1915	1151	626	87
1920	1270	718	109
1925	1088	1129	371
1930	1026	2170	419
1931	1013	2780	

There is a tendency towards amalgamation of societies, and to-day about 10 have each assets of over

/10 millions which aggregate more than half the total for the whole country

Buitenzorg town in Java 900 ft above the sea S of Batavia Dutch E Indies residence of the Governor General The climate is very agreeable to Europeans Buitenzorg is the capital of a Residency and celebrated for its remarkably well-equipped botanical gardens Pop (19 6) town c 47 000 residency 887 000

Bukovina, formerly an Austrian crown land transferred to Rumania on Nov 28 1918 In area it is 4030 sq m and has a pop of 846 000 (1930) composed mainly of Ruthenians and Rumanians It lies in the extreme N of Rumania Apart from the Dniester which traverses the N border Bukovina belongs to the Danube watershed Other rivers are the Pruth Sereth Moldava and Bistritza The winters are severe but the climate cannot be called unhealthy Salt is the only mineral rich deposits being found at Kaczka Nearly half the area is woodland the beech being very abundant Apart from the cultivation of wheat maize oats and barley some trade in brewing and distilling is done commerce being almost exclusively in the hands of the Armenians and Jews

Educationally Bukovina is not advanced there being a large number of illiterates There are no important towns Cernutzi (*Ger* Czernowitz) the capital has a pop (1930) of 111 000 and is the seat of a University Originally Bukovina was a part of Moldavia ceded to Austria by the Porte in 1777 Later it was incorporated with Galicia, but separated in 1849 to become an Austrian crown land

Bulawayo largest town of S Rhodesia 1400 m from Cape Town an important market and railway centre Lobengula the chief of the Matabele had his principal kraal on the site of the first settlement the modern town is 10 miles away Pioneer memorial by a and the

Matabele War Memorial Pop c 31 000 (11 800 Europeans)

Bulb (bot) an underground bud with scales The scales represent either whole leaves or leaf bases In the former case they are fleshy or dry according to their function of food storage or protection and ordinary foliage leaves are formed and grow above ground through the favourable season and then die immediately In the second case the foliage leaves break off and leave the bases to serve as protective organs and food reserves during the unfavourable period of the year and to nurture the young bud

Typical bulbs are those of the tulip hyacinth onion and lily The underground organs sold as bulbs of crocus are not bulbs in the strict sense but *corms* since the reserve food is stored in an enlarged and flattened stem

*Bulbs for Indoor Decoration* — Hyacinths are the favourites for spring flowering indoors at a time when few other flowers are available By careful attention flowers may be obtained right through the spring from very early weeks Christmas blooms are raised only by rapid forcing in heat but by ordinary methods flowering can be induced in the last weeks of January Heavy bulbs should be selected of good symmetrical shape free from any trace of disease and covered with fine textured and well coloured scales Bulb fibre or ordinary soil may be used The latter should be sterilised by pouring boiling water on it or by heating in an oven to destroy all eggs of pests which might harm the bulbs The fibre or soil should then be thoroughly damped and allowed to drain and placed in the pots on a layer of small broken bricks or other porous material A firm base should be made and covered with a little powdered charcoal and sand and the bulb placed upon it and firmly covered with soil to its neck It is a frequent mistake to grow bulbs in too large pots they tend then to develop roots rather than flowers The bulbs should be

put in a dark but well-ventilated cupboard and kept moist, but not too wet.

When the shoots are 1 in. high the bulbs should be brought out into the light and kept as far as possible in an even temperature. Extremes of heat and cold should be avoided, and watering carefully attended to, and, if the light tends to come from one direction the plants should be turned at intervals to prevent one-sided growth. Hyacinths should never be brought into a room in which gas is used. If mould should appear on the bulbs or soil, a thin dusting of sand should be given. Hyacinths may also be grown with success in water and no soil.

The culture of hyacinth bulbs has made much progress in the last few years, and bulbs are now obtainable which give large and thick spikes of flowers in all shades of blue, red, and yellow, and pure white, with an exquisite scent. Culture of tulips, daffodils, and narcissi proceeds in much the same way, but these bulbs are not suitable for water culture. Some of the smaller bulbs can be massed in bowls. A very small outlay on bulbs of scilla or chionodoxa gives a large number of tiny inflorescences of brilliant flowers, of deep blue in scilla and a vivid royal blue in chionodoxa, with a white spot in the centre. The yellow crocus is not suited for growth indoors, but the purple, blue, and especially the white ones are beautiful grown in shallow bowls or on plates, among stones, and covered with a small green moss. Each "bulb" produces up to six flowers with large petals and decorative reddish yellow stigmas.

*Bulbs for the Spring Garden.* Bulbs have the advantages of easy cultivation and early flowering before other plants can be induced to blossom. They take little room in the soil, and have only a small root system, and cast little shade when in full flower, so that herbaceous annuals and perennials can be sown or planted among them. If the garden includes a piece of woodland or a sloping grass bank,

bulbs should be planted thickly there and left year after year, to increase naturally. On grass banks which are shaded most of the day, snowdrops should be planted for early flowering, and chionodoxa, to make brilliant blue patches, a little later in the year. Scillas, blue, pink, or white, are also successful. Crocus is the most beautiful plant for grass banks. Crocus flowers, however, open only in bright sunshine, and therefore should be planted only where no shade falls.

Aconites, anemones, bluebells, Solomon's seal, as well as tulips, hyacinths, and the many varieties of narcissi and daffodils, may be grown in borders.

*Bulbul*, song-bird of India and other countries of the East, the name being derived from the note uttered. They are about the size of thrushes or smaller.

**Bulgaria**, a Balkan State situated in the N E of the Balkan Peninsula, W of the Black Sea. Its area is 30,814 sq m, its approximate pop (1931) 6,006,000—81 per cent Bulgarians, 10 per cent Turks, and the balance of various Slav races. Its boundaries are Rumania in the N, Turkey and Greece in the S, and Yugoslavia on the West. Agriculture is the chief source of national wealth, and in many parts of the country very primitive methods are still employed. Communes hold pasture-land and woodland in perpetuity, paying no rent for the right. About 80 per cent of the population are engaged in agriculture. Wheat and maize form the bulk of the crops, c 5,000,000 acres being under cultivation in 1932, two-thirds of it being sown with wheat. A considerable amount of fruit is grown in the Kyustendil area, S. of Sofia, and the sheltered rose gardens at Kazanlyk and Karlovo produce c 2000 kilograms of essence annually. Some cotton, sugar-beet, and tobacco is also grown, the latter in large quantities but not of a high quality. Sericulture, once important, is in decline owing to a disease which almost wiped out the silkworms.

Sheep are reared in greater quanti-

ties than any other animal goats pigs donkeys mules and cattle are also found in considerable numbers

Industry is not well developed and efforts are being made by the Government to stimulate it. Bulgaria is rich in coal other minerals are copper zinc lead lead-copper aluminium and salt. The principal imports are textiles metals oils and fats skins resin mineral salts and machinery their largest exports being tobacco with attar of roses maize eggs cocoons and sugar.

The legislative power is vested in the King and the Sobranie or assembly elected for 4 years by manhood suffrage. The internal government of the departments is controlled by the Minister of the Interior. There are many towns of more than 5 000 inhabitants the 4 largest being Sofia the capital with 213 000 Philippopolis 85 000 Varna a Black Sea port 60 000 and Rustchuk on the Danube 46 000. There are consular representatives at Sofia Varna and Burgas. The mercantile marine is small but the Black Sea port trades and shipping on the Danube are steadily increasing nearly 20 000 vessels entering annually. There are 153 m of standard gauge railway and 283 of narrow-gauge. Under the Treaty of Neuilly the Army must not exceed 90 000 raised under a voluntary system. No naval or military aircraft is permitted. The Navy is restricted to 4 torpedo-boats without torpedoes and 6 motor boats for use on the Danube.

The two mountain chains the Balkans and Rhodope are the most striking physical features. This mountain system provides the country with 3 main watersheds. The bulk of the water drains N into the Danube on its way to the Black Sea and S into the Maritza. In the N are the E Lom of commercial and strategic value to Rustchuk the Yantra Iskr Vid and Osem. The S rivers are important the Maritza with its tributaries the Tuna and Arda and the Struma.

A feature of Bulgaria is the number

of passes one of which the Shipka made history during the Russo-Turkish War 18 7-8 others are the Demir Kapu Dobral Tröian and Dragoman.

The climate is treacherous and severe with extremes of heat and cold the low swampy ground in the vicinity of the Danube is very unhealthy in summer.

There are few special features in Bulgarian fauna. The small brown bear abounds in the mountainous districts there are many wolves jackals lynx wild cat wild boar polecat. The domestic animals are similar to those of the other Near Eastern countries. The birds of Bulgaria are interesting but not unusual eagles vultures and kites are plentiful the red stork and the spotted cuckoo providing a variation. In the Danube sturgeon carp and sturgeon are found and the Black Sea provides turbot and mackerel.

Education is free and obligatory from 7 to 14 years there are many schools and a well-equipped University at Sofia.

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his abdication, the rise of Stamboloff, and the selection of Prince Ferdinand, by the Sobranye, as Prince of the Principality, opened up a new period of history. In 1908 Bulgaria declared her independence was recognised by the Powers, and Ferdinand assumed the title of King. The Balkan Wars (*qv*) were not fruitful for Bulgaria, and during the World War a further cession of territory took place, Thrace was handed to the Allied and Associated Powers, and the Strumitza line with a strip of territory to Serbia, these losses were perhaps less serious than at first imagined, and Bulgaria settled down to a new period of restoration with Boris III as King in place of his father King Ferdinand.

**Bulgarian Atrocities**, the massacres of some thousands of the Christian Bulgars in 1876 by their Mohammedan compatriots, in association with Turkish irregular troops. The atrocities aroused protests throughout Europe, especially in England under Gladstone, and were a contributory cause of the Russo-Turkish War of 1877.

#### Bulgarian Language and Literature

The language, though the Bulgars are not Slavs, is descended from Old Slavonic, which is very closely akin to Church Slavonic (*see* SLAVONIC LANGUAGES and RUSSIAN LANGUAGE). The literature begins in the latter half of the 19th cent with the poets Rakovski, Karavelov, Botev, and Slaveikov, and received a great stimulus with the liberation of Bulgaria in 1878. Ivan Vazov (1850-1922) is perhaps his country's greatest author, and his novel, *Under the Yoke*, has been very widely translated. Eline-Peline is famous for his story *The Earth*, and for children's stories. In lyric poetry Peutchko Slaveikov (*d* 1912), Yavorov (*d* 1914), Christoc, and many younger men, have produced first-class work.

#### Bull, *see* STOCK EXCHANGE

**Bull, John** (1563-1628), English Elizabethan composer who has been credited with the authorship of *God*

*Save the King*. Organist at Antwerp and Hereford Cathedrals. His music for virginals and organ shows considerable contrapuntal skill, and some charming works of his are still occasionally to be heard.

**Bulla**: (1) a stud of metal used in ancient times to ornament arms and equipment. (2) Pendant worn by Roman children, often containing a charm or talisman. (3) A seal, usually of lead, appended to documents, and origin of the word *Bull* as applied to documents bearing the Papal seal. The term is now obsolete.

#### Bull-baiting, *see* BEAR-BAITING

**Bulldog**, a dwarfed breed of the mastiff group (*qv*). It was probably derived from the dog formerly used for bull-baiting, which apparently resembled a small mastiff but had a shorter nose. At the present time bulldogs are heavily built, short-legged, and broad-chested, the head being massive, with the lower jaw protruding and the nose set back nearly between the eyes. They are inactive, delicate dogs, useful only for show purposes and as pets. The French bulldog differs from the English in having so-called "bat" ears.

**Buller, Sir Redvers Henry** (1839-1908), British general, entered the Army 1858, and served in China, Egypt, and S Africa. Was associated with Lord Wolseley 1873-4 and 1884-5, promoted general, 1890, served in the Boer War 1881, and the S African War 1899-1900, where his ability as a commander was questioned owing to the success of the Boers in the initial stages of the war. He was superseded in the chief command by Lord Roberts in 1900.

**Bullet**, a small-arms projectile, developed from the small round lead shot used in early smooth-bore muskets. They were weapons of little precision, and the invention of rifling brought a radical change of design. Expandable lead bullets, which filled the rifling after the explosion, were introduced in 1836, and

ensured greater pressure and a bullet spin which made for accuracy. A cylindrical bullet was invented by Minié in France in 1869. Modern bullets are cased in copper nickel or steel and are variously filled. Incendiary bullets are used against air craft, and a lead and tool steel bullet for armour piercing. Dum-dum bullets with a lead cap which spreads on impact are forbidden in war. The calibre of a bullet varies from  $\frac{1}{4}$  in to 1 in.

**Bull fighting** the national sport of Spain was probably introduced by the Moors. In early days nobles and



Bull fight (T. J. L. The toros are the men and the banderos are standing by)

even kings took part but since the 14th cent. the sport has been mainly in the hands of professional bull fighters. The bulls used are specially bred for the purpose. Almost every town in Spain has its *plaza de toros*. A bull fight or *corrida* begins with a procession round the arena after which the first bull is loosed and engaged by the *picadores* men mounted on blindfolded horses who receive the bull's charge and try to thrust a short pike (*garrocha*) into his neck. Horses are often gored by the bull in this part of the entertainment. When the *picadores* have left the ring *banderos* enrage the bull by waving red cloaks and plant in his neck 4 pairs of *banderillas* darts adorned with streamers. Finally the now weary bull is dispatched with a sword by the principal bull fighter the *espada* or *matador*

who brings the bull into position by waving a small red flag and then endeavours to kill him with a single thrust through the neck. Six bulls are generally killed in one *corrida*. In a Portuguese form of bull fighting the bull's horns are blunted and the horses padded. The bull is seldom killed in Portugal but always in Spain.

**Bullfinch**, see FINCH

**Bullfrog** see FROG

**Bullion**, gold or silver in bulk & in bars (as distinct from coin which is called specie). The gold reserve of the Bank of England is kept in both bullion and coin. Gold bars usually weigh c. 400 oz. though smaller ones are used for shipment to India.

**Bull Run** river of USA in Virginia the scene of two battles in the early stages of the American Civil War (1861 and 1862) in both of which the Southern forces won victories.

**Bulow** (*Bernhard Heinrich Karl Martin*) Prince von (1810-1909) German statesman and internationalist born in Holstein. He entered the diplomatic service 1874, trained at embassies in Vienna 1877, Paris 1880 and Petrograd 1885. Bülow was Ambassador at Bucharest 1888, at Rome 1894-7. In 1897 he became Prussian Minister for Foreign Affairs and in 1900 Chancellor of the Empire and Prussian Premier. Bülow directed Germany's foreign policy from 1898 to 1909, a period which included the tentative proposals for an Anglo-German treaty, the Moroccan crisis, the Krüger telegram and the Treaty of Björkö. He was made Prince in 1905. In 1909 a budget crisis caused his resignation and he retired into private life. He was Ambassador at Rome 1914-17 but again retired on Italy's declaration of war. Lived in Switzerland and Kleinfeldtbeck and died in Rome.

**Bulrush**, a plant of the sedge family which resembles a gigantic rush and grows on the banks of rivers and ponds. It has a stout cylindrical nearly leafless stem which may attain a length of 8 ft. and bears the

flowers in a lateral cluster Bulrushes flower in early summer Their stems are often woven together to form matting

The name is also erroneously applied to the reed-mace, a rush which grows in similar situations, but whose stem bears long strap-like leaves and a terminal club-like spike of flowers, the lower part of which is fertile and the upper barren The well-known brown spike is composed of the hairy one-seeded fruits clustered together

The bulrush of Scripture was *Papyrus*, another member of the sedge family

**Bulwark**, a timber and earth barricade used in the 15th and 16th cents as a mounting for artillery Also the protective wooden barricade around the deck of a ship

**Bulwer-Lytton**, Edward George, 1st Baron Lytton (1803-1873), playwright and novelist His novels, *Eugene Aram* (1832), *The Last Days of Pompeii* (1834), *Rienzi* (1835), *The Lord of the Barons* (1843), and *Harold* (1848), were immensely popular His plays include *The Lady of Lyons* (1838) and *Money* (1840) He entered Parliament in 1831 and was, from 1858 to 1859, Secretary for the Colonies He was made a baron in 1866

**Bumble Bees**, large hairy bees, social in habit like the honey bee (*q v*), but distinguished by their large size and bright colours Their life-history very closely resembles that of the wasps (*q v*), in that the whole community perishes in the autumn, except a few fertilised queens Each queen starts a fresh colony in the spring In a hole in the ground, or in thick herbage, she makes a nest of grasses, in which her first eggs are laid in cells of wax, and she feeds the grubs which, turning into sterile females or workers, relieve her of all duties except that of laying egg. For these the workers continue throughout the season to make fresh cells, and they bring in food for the grubs and queen.

**Bundelkhand**, a part of the Central

India Agency, consisting of 22 States, the chief being Datia (911 sq m, pop 150,000) and Orcha (2070 sq m, pop 285,000), inhabited mainly by Hindus It is rough and uneven, with jungle where roam tiger, leopard, hyena, and jackal Of the many rivers, few of which are navigable, the most important is the Jumna At one period there was a considerable diamond industry, near Parma, now in decline A portion of the present area was ceded to the India Company by the Treaty of Bassein in 1802, after which the conduct of certain chiefs necessitated several military expeditions, the result being the Treaty of Poona, June 13, 1817

**Bunin**, Ivan Alexeyevich (b 1870), Russian author and translator into Russian of English poems, *eg* *Hilf mir*, *Manfred*, and *Lady Godiva* His own verse is descriptive and colourful, but he is best known for his stories, of which *The Village* and *A Gentleman from San Francisco* have been translated into English

**Bunion**, an inflamed swelling of the sac containing the lubricating fluid on the joint where the big toe joins the foot Less frequently it may occur on the little toe The cause is generally tight boots or some other cause producing pressure, and the treatment is to remove the pressure, rub, or otherwise manipulate the joint, and apply dressings If not attended to, bunions may lead to ulcers or even gangrene, and in extreme cases it may be necessary to operate

**Bunker Hill**, slight eminence N of Boston (Mass.), forming with Breed's Hill a narrow peninsula In 1775 the first pitched battle of the War of American Independence was fought here, June 17 The British were successful, but suffered very heavy casualties in a frontal assault, and it proved a Pyrrhic victory

**Bunkering**, taking on board ship coal or other fuel, originally by barks, and now largely by mechanical means A normal mechanical unit

loads 125 tons an hour See also  
COALING STATION

**Bunsen, Robert Wilhelm von** (1811-1899) German chemist professor at Cassel, Marburg and Heidelberg one of the greatest practical teachers of chemistry His inventions and discoveries include the charcoal pile the metallisation of magnesium spectrum analysis and the burner and cell which bear his name The Bunsen burner burns 3 parts of air to 1 of gas and is the most widely used laboratory flame the Bunsen cell a voltaic battery contains 2 separate plates surrounded by separate acids and was used to produce an arc

**Bunsen Burner** gas burner in which the gas is caused to escape from a fine jet into a tube open at both ends the mouth of the jet being at or near one end of the tube The velocity of the gas in the jet causes air to be drawn into the tube where it mixes with the gas the mixture burning where it issues from the tube at the other end The burner was originally used by Bunsen in the chemical laboratory and there provided for the first time a perfectly clean and easily controllable flame

The Bunsen principle is applied in all domestic heating apparatus employing gas Every different type of burner requires to be very correctly proportioned as regards length size of air inlet size of gas jet and size of burner hole If any of these factors are incorrect the burner will not function satisfactorily one of the commonest and most annoying faults being lighting back when turned low A well-designed burner can be turned down to the merest flicker without lighting back and yet have a full supply of air when fully turned on

**Bunting** bird related to the finches and found in both hemispheres The commonest British species is the yellow hammer while on the Continent the ortolan is greatly prized for its delicate flavour

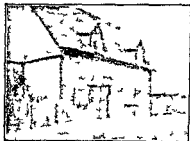
**Bunyan, John** (1628-1688) author of *Pilgrim's Progress* was born near Bedford

and became a tinker He was of a grave and sober character and soon developed into a Puritan of the strictest kind From an early age he suffered much mental anguish which almost amounted to religious mania accusing himself (without any justification) of every kind of vice He served in the Parliamentary army in 1645



John Bunyan.

Later he joined the Baptists of Bedford among whom his sermons began to become famous for their fervour and piety After the Restoration he was in 1660 imprisoned in Bedford Gaol for his opinions and preaching and there he remained for 12 years During his imprisonment his books were written the first being *Grace Aboundeth* (1666) his spiritual autobiography His greatest work *Pilgrim's Progress* one of the finest allegories of all literature was begun in prison and published in 1678 It immediately became popular and ten



Bunyan's Cottage in Elstow Beds.

editions had appeared by 1685 The *Life and Death of Mr. Bunyan* (1680) the second part of *Pilgrim's Progress* (1684) and the *Holy War* (1687)

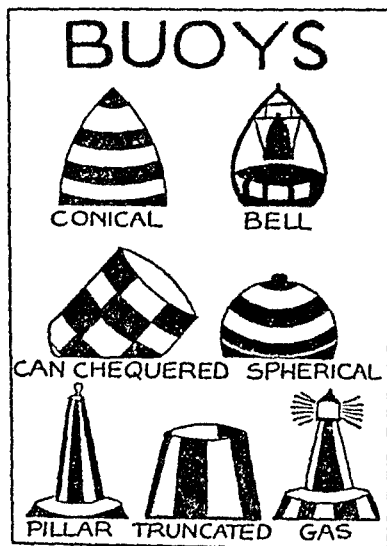


quickly followed Bunyan died of a fever in 1688, and was buried in Bunhill Fields, London

During the 18th cent only the lower middle classes read his books, and it was not until comparatively recent times that they were recognised to be of great literary, as well as religious, value

**Buonarrotti**, see MICHELANGELO

**Buoy**, a small floating vessel moored in a waterway for the purpose of serving as a mark for navigation. Buoys are also used to give warning of all kinds of dangers, such as from



sunken rocks or sands, they are also commonly employed attached to moorings which are not in use. They are distinguishable by their shape, colour, and, on rarer occasions, by carrying lights or means for producing sound, such as bells and whistles. The primary distinction of shape is between the *conical* type and the *can* type. The former has a pointed top showing above water, which, in the United Kingdom, denotes that it should be

passed on the starboard (right hand) when moving with the main stream, or entering a harbour, river, or estuary from seawards. The *can* buoy similarly denotes the left hand (port side). Spherical buoys mark the ends of middle grounds, that is to say, shallow places in the middle of a channel. Pillar buoys have a tall central structure on a broad base, and are used to mark special positions.

There are also special rules concerning the colour of buoys, for example, green is used for buoys marking a wreck. Buoys are all made of steel plate, they require to be of very substantial construction owing to the danger of their being run down by ships. They are moored by chain cables to heavy blocks of cement, except when used for moorings, in which case they are usually taken on board the ship when the mooring is in use. Many types of *light-buoy* are in use, the source of light being almost invariably compressed gas of various kinds. Light-buoys are also provided with devices by which the light is dimmed at definite intervals, such buoys are to be found in all large estuaries, such as the Thames. As the interval of all the important light-buoys is given on the chart, they help the mariner to make sure of his exact position. *Bell* buoys and *whistling* buoys are similarly distinguished, and, especially in estuaries liable to heavy fogs, may be of great service in giving warning of approach to danger. All buoys have distinctive marks and lettering, and are entered in charts and sailing directions, so that they can be identified by the navigator.

**Burbage, James** (d 1597), English actor, and leader of the Earl of Leicester's company of players, erected in 1576 the first permanent theatre (known as "The Theatre") in London, he also built the Blackfriars Theatre in 1596, and seems to have been concerned in the erection of the Curtain Theatre. His son, *Richard Burbage* (c 1567-1619), the most celebrated

actor of his day pulled down The Theatre and built the Globe with the materials (1598). He was closely associated with Shakespeare and took the principal parts in many of his plays. He was also a painter.

**Burdett, Sir Francis** (1810-1844) English politician M.P. 1796 and 1807. He opposed the French war and agitated continuously for parliamentary reform but he voted with the Conservatives from 1830 onwards.

**Burdett-Coutts, Angela Georgina, Baroness** (1814-1906) created a peeress in her own right in 1871 married W. L. Ashmead Bartlett in 1881. Among her many philanthropic activities she caused destitute boys to be trained for sea service and was one of the founders of the Society for the Prevention of Cruelty to Children.

**Burdett-Coutts, Wm. Lehmann Ashmead Bartlett** (1851-1921) politician born in the U.S.A. He married Baroness Burdett-Coutts in 1881 assuming her name. Was Commissioner in Russo-Turkish War 1877. M.P. for Westminster 1885-1901. *The Times* correspondent in S. Africa 1900. Interested in philanthropic and social questions. Made Privy Councilor in the year of his death.

**Burdock**, a picturesque plant common on waste spaces belonging to the Compositae family. It grows c. 5 ft. high and has large handsome lower leaves and a terminal panicle of large heads of purplish florets enclosed in a whorl of hooked scales. The seeds become hooked to the coats of passing animals and are thus conveyed to a distance.

**Burdwan** (1) District of S. Bengal on the W. side of the Hughli. The area near the river is almost entirely agricultural but the higher ground farther W. includes a large coalfield and iron works. Silk weaving is a widely diffused industry. Area 2,000 sq. m. Pop. c. 1,410,000.

(2) Capital of (1). It is really an aggregation of villages about the palace of the Maharaja of Burdwan. There are numerous tombs and tem-

ples of great interest in the vicinity. Pop. c. 35,000.

**Bureau**, a writing-desk deriving its name from that of a coarse cloth formerly used for table tops. In its modern use it is also applied to offices more especially those where information is received or supplied e.g. travel bureau.

In the 18th cent. bureau bookcases became fashionable and Hepplewhite (qv) was particularly successful in designing them. See **DESK**.

**Burette**, see **ANALYTICAL CHEMISTRY**.

**Burgage Tenure** in old English law a tenure where some person was lord of an ancient borough in which the lands were held in return for the payment of a rent service. Its principal custom called *borough english* was that the land of an intestate tenant passed to his youngest son. See also **TENURE**.

**Burgenland** E. frontier province of Austria. The S. is well wooded with mountains crowned by many castles and ruins. The capital Eisenstadt is noted as the place where Haydn (qv) did a certain amount of composition. Before the World War the territory was Hungarian. Pop. c. 37,000.

**Burgess** originally a citizen of later narrowed to a freeman possessing a tenement in a given borough. In 1855 members of this class were specifically summoned to attend Parliament 2 from each borough from whence springs the representation of boroughs in our present House of Commons.

**Burghley (or Burleigh)** William Cecil, Lord (1520-1598) English statesman. By two marriages and a series of cunning dissimulations he managed to become a favourite of three rulers—Somerset the Protector of Edward VI. Mary and Elizabeth. Ultimately he became the most powerful of Elizabeth's ministers. With great skill he avoided the traps that were strewn by jealous nobles and by the changeableness of the Queen and retained not only his position

but a high reputation for honesty. He was raised to the Peerage in 1571, and was Lord High Treasurer, 1572-98.

**Burglary**, the breaking into and entering by night of the dwelling of another with intent to commit a felony therein, or the breaking out of the dwelling-house of another, having entered it with intent to commit a felony therein. Burglary is a felony punishable with penal servitude for life.

**Burgos**: (1) mountainous province of N Spain extending from the Cantabrian Mountains to the region just S of the Douro. The N of the province is watered by the Upper Ebro. Agriculture is the occupation of almost all the inhabitants, cereals are the most important crops. Forests cover a large part of the province. Coal, quartz, and salt are obtained. Electric power is widely distributed. Area, 5480 sq m, pop (1931) 355,800. (2) Cap of province and former cap of Castile. Pop (1931) 40,161. Its great feature is the fine Gothic cathedral, which took more than 300 years to complete, and includes the famous Condestable chapel. In the town leather goods, cloth-weaving, and hosiery are the most important industries. In the 15th cent Burgos was made a royal residence, but the transference of the capital to Madrid introduced a period of decline.

**Burgoyne, John** (1722-1792), English general and dramatist, fought in the Seven Years' War, and in the American War of Independence, when he was blamed for the surrender at Saratoga (1777), the turning-point of the campaign. His plays include *The Lord of the Manor*, and *The Heiress* (1786).

**Burgundians** (1) see **BURGUNDY**. (2) The supporters of the regent Philip of Burgundy in the French Civil War, between the regent and the followers of the Duke of Orleans in the 14th cent.

**Burgundy**, name applied with vary-

ing significations at various dates to portions of the Franco-German and Franco-Swiss border regions. The Burgundian kingdom (406-534) was founded by the Burgundians, a Germanic people originally allied to the Romans. In 937 two kingdoms of Provence and trans-Jurane Burgundy were united as the kingdom of Burgundy or Arles, which in 1032 became part of the Holy Roman Empire. From the 13th cent it was gradually absorbed by France. The so-called Duchy of Burgundy, a fief of the French crown, was the northern part of the earlier Burgundian kingdom; the southern part coincided roughly with Franche-Comte (*q v*).

**Burgundy, Dukes of**. The early Dukes of Burgundy belonged to the Capet (*q v*) family, but in 1363 the second house (variously called the second Capet or the Valois) was founded by Philip the Bold. This house, which included also John the Fearless, Philip the Good, and Charles the Bold, continued in power, enlarging its dominions until 1477, when the duchy was combined with the crown of France by Louis XI.

**Burhanpur** [BOOR'HAN-POOR], town on the R Tapti, Central Provinces, British India. Textiles, embroidery, and gold and silver thread are the principal manufactures. The town has many memorials of its past under Mohammedan rule. Ancient buildings include the palace, numerous mosques and tombs, and the fort. Pop c 30,000.

**Burial**. In England, on the death of a person, the survivors, relatives, executors, or the householder in whose house the body lies, have a duty to bury or otherwise dispose of it in a proper manner. Interment need not be in any particular place or with any particular ceremony, provided it is carried out in a decent manner, and does not endanger the health of the community. Cremation was lawful even before the Cremation Act, 1902, which merely regulates how it is to be carried out. A person cannot by wil-

r otherwise dispose of his body after death and any directions he may leave are not binding on his representatives except in regard to the anatomical examination of his body after death or unless he has expressly forbidden cremation. Further every person has the right to be buried in the burial ground or churchyard of the parish wherein he dies except executed felons who are buried in a place appointed by the Home Office generally the precincts of the prison where the execution took place. With regard to the service no body could be buried in consecrated ground except with the service of the Church which the incumbent of the parish or some person authorised by him was bound to perform but this was refused to excommunicated persons suicides unbaptized persons and unrepentant criminals. Since 1880 on proper notice being given to the minister burial may take place in a churchyard without performance of the service of the Church of England either without any religious service at all or with a Christian and orderly religious service conducted by any person invited to do so by the person in charge of the burial. Clergymen of the Church of England are allowed but not obliged to use the burial service in any unconsecrated burial ground in any case in which it would be used in consecrated ground. The bishop may also approve a special form of service in cases where it is desired and the ordinary form cannot be used. The guardians or overseers are responsible for the burial of a pauper dying in a parish house and the Coroner has a similar responsibility in the case of suicides. Reasonable funeral expenses are payable out of the estate of the deceased with priority over all other charges. See also RELIGION LAWS.

**Buriat-Mongol Republic** [*Buriata-Mongol* is a(n) autonomous republic of the USSR in Central Asia created in 1933 embracing the area l of Lake Balkal. It is mainly hilly cattle rearing is the most important source

of wealth. Agriculture is confined to the river valleys and mineral wealth although believed to be vast is little developed. Some gold and manganese are mined. Glass and leather manufactures are of some importance. The inhabitants are chiefly of Mongolian race and a large number are still nomadic herdsmen. The principal town is Verkhne Udiinsk (c 90 000). Area c 150 000 sq m pop c 576 000.

**Buridan Jean** (c 1300-1358) French philosopher. He studied under William of Occam and became rector of the University of Paris. He stated that the will is dependent on the intellect. He devised rules for discovering the middle term in logic (his *pons asinorum* or Buridan's ass) but the statement attributed to him that an ass standing between two equidistant bundles of hay would starve to death having no power to choose between two equally strong attractions is not found in his works. It is suggested in Aristotle and Dante.

**Burin**, see STONE AGE.

**Burke Edmund** (1729-1807) English statesman and author. His political career began in 1759. As secretary to Hamilton the Earl of Halifax and the Marquis of Rockingham he gained an inside knowledge of politics which he put to good use when he became a Member of Parliament in 1768. Until then he had been a member of the literary club that included Dr Johnson Sir Joshua Reynolds and Garrick and Johnson had a high opinion of Burke's conversational powers. His reputation for eloquence grew in the House although his attacks on its methods gained him much opposition. In 1774 he met Charles James Fox his great supporter and pupil.

Throughout the period that ended with the American War of Independence Burke played an important part and his speeches recommending conciliation are justly famous. The next ten years saw him as the unsuccessful originator of several unpopular Bills and in 1788 he made use of his elo-

quence in the impeachment of Warren Hastings. Even his brilliant speeches, however, failed to secure a conviction. His unpopularity at that time was very great.

The French Revolution of 1789 gave rise to his greatest work, the *Reflections on the Revolution in France* (1790). In it he attacked mob-rule and the overthrow of an ordered state, and Tom Paine wrote his famous *Rights of Man* in reply. Burke hereafter became suspicious of every reform movement, and this led to his quarrel with Fox and his desertion of his party. In 1795 Hastings was acquitted, and Burke retired from political life. His last work was the *Letters on a Regicide Peace*.

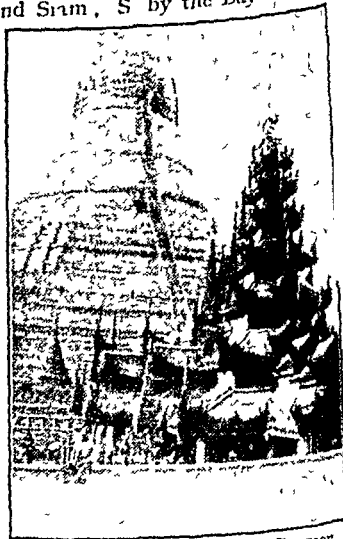
**Burke, William** (1792-1829), Irish murderer, lived in Edinburgh working as a navvy and lodging in a house kept by William Hare. When an old fellow-lodger died, Burke and Hare sold his corpse to a Dr Knox, an eminent anatomist. The two men, anxious to continue this means of earning a livelihood, decided to take steps to overcome the shortage in the supply of corpses, and one after another over a dozen persons were decoyed into lodging-houses, plied with drink, and then suffocated their corpses bringing in sums varying from £8 to £14—and all being sold to Dr Knox. When Burke and Hare were finally arrested, Hare turned King's evidence, and Burke was hanged. Hare left Scotland and disappeared, nothing being known of his later life.

**Burlesque** is the treatment in literary or dramatic form of dignified and elevated subjects in a ridiculous and comic fashion. Thus it is the converse of the mock-heroic (*qv*). Chaucer's "Rime of Sir Thopas" in the *Canterbury Tales* is a burlesque of the mediæval metrical romance.

**Burlington House**, the Piccadilly home of the most popular English art exhibition, the "Royal Academy," which body has for many years held annual shows representing the work of the country's more conventional

artists. The house was erected in 1669-72, on the site of an older building dating from the 17th cent., the residence of the Earl of Burlington. Besides the annual exhibition of the Royal Academy, the building houses permanent exhibitions and accommodates various societies.

**Burma**, province of British India, divided into Upper and Lower Burma, bounded to the N. by Tibet and China, E. by Yunnan, French Indo China, and Siam, S. by the Bay of Bengal.



Burma. Shwë Dagon Pagoda at Rangoon. Gulf of Martaban and Siam, and W. by Assam, Manipur, Bay of Bengal, and Chittagong. A semi-circle of mountain ranges marks the N. frontier; the country is intersected by parallel ranges N. to S. In the narrow valleys plains flow the chief rivers, all to the S. The only great plain is the valley of the Irrawaddy. The highest peak is Mount Saramet (12,557 ft). Other are the Karenni hills in the S. (8000 ft) and ranges of 6000 ft in the Favo. The climate is generally hot and moist, with heavy rain in the mountains and little in the central areas.

During the very hot months the Government moves to Maymyo a hill station 3000 ft above sea level.

The civil capital is Rangoon (pop 400 415) but Mandalay (pop 147 93) is still the religious capital. Other important towns are Dinsabyu centre of the tobacco and cigar industry. Pagan is historically the most interesting town. Yangon the oil city of 500 wells and Phamo centre of the over land trade with China.

Petroleum is found in rich fields in Magwe Myingya and Pakokku silver and lead in the N Shan States coal of poor quality in the tertiary deposits of the Irrawaddy tin and oil from Mergui iron in many parts. In most of the Upper Burma rivers gold is dredged. The ruby mines are famous for their output and the richness of colours of the stones the finest coming from Mogoke. Jade and amber are mined in the Myittha district of the Hukong valley. Amber which lies 40-40 ft down is slightly harder and heavier than that of the Baltic. Most of the jade output goes to China. Most important industries and manufactures are silk weaving centred in Mandalay gold and silver work Rangoon and Mandalay ivory carving at Moulmein and cigar manufacture at Rangoon. Burma produces a large crop of rice chiefly in the Shan States. Coffee and tea are grown also cotton in the dry districts. The irrigated tracts of the dry zone and higher ground in the wet zone grow custard apples pineapples oranges guava mangoes nango banana and coconut. Teak woods are valuable as is rubber.

### Fauna

Wild animals abound in the vast forests chiefly the elephant tiger leopard rhinoceros bear and jackal. In the creeks of the delta and in Arakan alligators are still found. Birds and reptiles are varied and numerous peculiar to Burma and Indo-China being the lizard known as Taute from its curious call.

Main exports are rice mostly taken by England beans petroleum timber india rubber cotton tin wolfram and precious stones. The first railway was opened in 1877 but now more than 9000 m are operating under the Government of India. The Irrawaddy is navigable for 900 m and its tributary the Chindwin for 300 m. Roads are metalled for 9000 m and formed for a further 8000 m. The Irrawaddy rises outside Burma and runs through it S to the sea. The Salween rises in Tibet and flows S through the Shan plateau it is suitable for small boats but is used



Burma Native Weaving Cotton with Wood Machi

mainly for floating timber from the forests.

Burma is said to be the most literate province in British India. There are Buddhist teachers supplied by the monasteries in every village and a University controlling higher education. English schools are under Government control and vernacular education under local bodies. At Rangoon is a University and a number of Institutes for forestry agriculture research and technical purposes are centred in Rangoon and Mandalay. The civil and military police force consists of 25 000 officers and men. Government is by a Legislative Council of 103

members, of whom 80 are elected and the remainder nominated

### History

As early as 1612 the E India Company had agents and factories in Burma. Later a British Resident was appointed, but in 1824 trouble broke out culminating in the first Burmese War. In 1826 Burma ceded part of her territory to the British. The second war, 1852, gave Britain Rangoon and Lower Burma, and in a third war, 1885, King Theebaw was defeated and Upper Burma annexed. The Royal Commission on the Government of India, 1928-30, advised the separation of Burma from India if that was the expressed wish of the people. In 1932 a vote was taken, resulting in a small majority against separation. Area, c 263,000 sq m, pop (1931) 14,667,146.

**Burmese Wars**, see BURMA, *History*

**Burnand, Sir Francis Cowley** (1836-1917), English humorist, was the author of several burlesques and farces. He wrote for *Punch* and *Punch*, and in 1880 became the Editor of the latter. *Happy Thoughts* contains a collection of his *Punch* contributions.

**Burne-Jones, Sir Edward Burne, Bart.** (1833-1898), English painter and decorative artist. At Exeter College, Oxford, he became the close friend of Wm Morris, and an admirer of D G Rossetti. He abandoned his university career, and went to London in 1856, where he and Morris together worked for a time under Rossetti. Burne-Jones travelled through Italy in 1859, when his enthusiasm for the Italian primitives increased. On his return to London he exhibited a series of pictures, including the *Mirror of Venus*. He also did much decorative work and designs for stained glass, as well as tapestry designs and drawings for the Kelmscott Press. He was elected an A R A in 1885, but resigned 8 years later.

Burne-Jones never saw the æsthetic possibilities of the actual world,

but painted with romantic longing the imaginary figures of his dreams of the past. His influence was far greater on the decorative art of the day than on painting. With Morris, he revived temporarily the mediæval handicrafts of stained-glass and tapestry making, and of drawing upon vellum.

**Burnet, Gilbert** (1643-1716), English latitudinarian divine, Bishop of Salisbury, 1689. He is famous for his posthumously published memoirs, entitled *History of his own Times*, which are a valuable historical document.

**Burnett, Frances Eliza Hodgson** (1819-1921), novelist and dramatist, English born, but went to America in 1865. Of her stories, the best known is *Little Lord Fauntleroy* (1886), which was later dramatised and adapted for the screen with great success.

**Burney, Fanny** (1752-1840), English novelist, was the daughter of Dr Charles Burney, the musician. She moved in a brilliant social circle, and was a friend of Dr Johnson. Her first novel, *Evelina*, appeared anonymously in 1778, and was a great success. *Cecilia* followed in 1782. From 1785 to 1791, she was a Keeper of the Robes to Queen Charlotte, but the nervous strain of attending at Court seriously undermined her health. In 1793, she married a Frenchman, Alexandre D'Arblay. Among her most interesting works is her *Diary and Letters*, which gives delightful pictures of the literary and Court society of her time, revealing a keen observation and a piquant sense of humour.

**Burnham, Edward Levy-Lawson, 1st Baron** (1833-1916), English journalist and newspaper proprietor, editor of the *Daily Telegraph*, and later its manager and proprietor (1885). Retired in favour of his son, and received a barony, 1903.

**Burnham, Harry Lawson Webster Lawson** (1862-1933), 2nd Baron and 1st Viscount Burnham, chairman of the committee which fixed standard scales ("Burnham scale") for the payment of teachers. He was twice

President of the International Labour Conference at Geneva and served on the Indian Statutory Commission (1917-30)

**Burnham Beeches** a fragment of woodland N.W. of Slough Bucks containing historic beeches and large stretches of common land in all c 380 acres purchased by the Corporation of the City of London in 1879 and dedicated to the public use. It was augmented later by a gift of Fleet Wood (75 acres adjoining) by the 1st Viscount Burnham (1911)

**Burnisher** see ENGRAVING

**Burnley** town in Lancs 30 m N of Manchester. Cotton weaving the manufacture of iron ware worsteds and coal mining are the principal industries. Pop (1931) 98,300

**Burnous** [βύρνοος] the long voluminous hooded cloak commonly worn by Arabs and Berbers in N. Africa. It is made from a coarse woollen material sometimes woven from camel's hair and is generally white.

**Burns.** Strictly speaking a burn is an injury to the body caused by heat but the use of the word has become extended to cover similar injuries produced in other ways. Thus dry heat such as that of hot metal or naked flame and moist heat such as that of steam or boiling oil produce well defined types of burn and scald respectively. Injuries by corrosive acid such as spirits of salts or oil of vitriol or corrosive alkali such as quicklime or caustic soda are examples of burns produced by chemical substances. Injuries on the other hand which are produced by lightning electric shock, or X rays are examples of burns produced in a manner which is less clearly defined. Lastly when we come to describe heat stroke resulting from over-exposure of the body to the heat of the sun we do not use the word burn at all.

Burns have been classified according to the amount of injury which they produce and have been divided in this way into recognised degrees as shown in the following table

### Burns of

### Produce

1st Degree	Reddening of skin
2nd Degree	Blistering
3rd Degree	Destruction of outer layers of the skin and a scar which is white and shining
4th Degree	Destruction of all layers of skin and a scar which is depressed and puckered
5th Degree	Complete charring

The effects of burns can be divided into local (as shown in the above table) and general.

The destruction of tissues is complicated by the fact that it is accompanied by the production of substances in those tissues which are highly poisonous to the rest of the body. Hence unless the tissues which are burnt are removed a general toxicity of the blood may follow. Modern treatment of burns of the 3rd and 4th degrees consists in removal of the burnt tissues while the patient is under an anaesthetic and then spraying the affected part with a solution of tannic acid.

In this way the superficial tissues are converted to a black leathery substance which forms a coat under which complete healing can take place. When healing is complete the black layer becomes detached leaving in many cases an area of skin which is perfectly healthy. In carrying out this form of treatment special care must be taken to kill all micro-organisms on the site of the injury for secondary infection from these organisms is the other dangerous complication of all burns producing a broken surface of the skin. The microbe concerned may be one of the less harmful ones which are normally present on the skin but it may also be one of the dangerous variety which are also present in which case secondary effects of a very serious nature may follow. When the injury is sustained during the course of a fire whether in a building or outside as in



a railway accident, then the wound is liable to become contaminated with dirt or soil and in this case organisms producing tetanus (*qv*) may gain entrance to the body.

In addition to treatment of the wound itself a most important procedure consists in alleviating any symptoms of general shock, for shock, in the form of faintness or collapse, is a frequent accompaniment of burns, even of the most trivial kind. To ensure this alleviation the patient should be placed lying down and should be kept warm.

In cases of burns from electricity or lightning stroke the treatment of shock is even more important. The patient may appear to be lifeless, but there are cases on record where breathing and pulse have returned after artificial respiration has been carried out for several hours.

**Burns, John** (b 1858), Labour politician M.P. (Battersea), 1892-1918, and a member of the first London County Council Cabinet Minister and President Local Government Board, 1905-14, President Board of Trade, 1914, but resigned on Britain's entry into the War.

**Burns, Robert** (1750-1796), Scots poet, the son of a small farmer spent his youth in farm-labouring, reading widely and idling and drinking in Lochlea and Irvine. His father's death in 1784 burdened him with the support of the family, and until 1788 he laboured on their farm at Moss-giel. The year 1786 saw the issue (at Kilmarnock) of his first volume, which met with instant success. It included *The Collar's Saturday Night*, *To a Mouse*, *To a Daisy*, and many of his best songs. He was taken up by Edinburgh society, "honoured," and flattered and introduced to the artificial life and letters that were fashionable at the time.

*Auld Lang Syne* and *Tam o' Shanter* were written in 1788-9. In 1791 Burns was appointed excise-officer of Dumfries. Here he wrote over one hundred songs, and his prolific output was

brought to an end only by his death on July 21, 1796.

Burns's love of Nature and humanity, shrouded in some of the finest songs of all time, made him the national poet of Scotland. His was the charm of perfect simplicity and sincerity.



Robert Burns

**Bur-reed**, a large aquatic plant which might be mistaken at a distance for a flag, or iris, with sword-shaped leaves, and globular heads of flowers. Common in ditches, and flowers in July and Aug.

**Bursar**, keeper of the *bursa* or purse, now chiefly the treasurer of a school or college, or in a special sense the holder of a scholarship. Cf *purser* or paymaster on board ship.

**Burslem**, one of the Five Towns of the Staffordshire Potteries, now included in the borough of Stoke-on-Trent. It was for long the chief centre for the manufacture of pottery in England. Several generations of the Wedgwood family had been engaged in the Burslem industry, before the famous Josiah (*qv*) was born in 1730. Pop c 40,000 (see STOKES-ON-TRENT).

**Burton, John Hill** (1809-1881), Scots historian, is remembered for his epoch-

making *Life of David Hume* (1846) and his *History of Scotland* (1853-70). His contributions to *Blackwood's Magazine* were collected into *The Book Hunter* (1861) and *The Scot Abroad* (1864) which are marked by a dry humour of a delightful kind.

Burton, Sir Richard Francis (1831-1890) famous explorer and Orientalist. To a knowledge of Eastern tongues, manners, and custom, he added great personal courage and disregard of convention. His translation of the *Arabian Nights* is his most celebrated work. He spent his life in the Army and the Consular Service and took advantage of his official position to study native life incorporating his studies in a number of books. He was one of the pioneers in opening up Equatorial Africa.

Burton, Robert (1577-1640) English author, student at Christ Church, wrote the famous *Anatomy of Melancholy* under the pseudonym of *D. Moriculus Junior* in 1621. It is a work of great learning and humour.

Burton-upon-Trent, industrial town of Staffs. on the upper Trent celebrated for its breweries which date back to the early part of the 18th cent. the local water has a high lime content peculiarly suitable to brewing. Other industries such as barrel making are mostly ancillary to the main one. Burton was early of importance as a monastic town. It had an annual fair in the 13th cent. Pop. (1931) 49,500.

Buru (*Boroe*) mountainous island of the Molucca group Dutch E. I. Id. The highest ranges are over 8000 ft. The forests (tropical and climatic) are extensive and valuable vegetable oil is the staple product. The inhabitants belong to the Malay race. Buru forms part of the residency of Amboina (q.v.). Area c. 3400 sq. m. pop. c. 20,000.

Bury industrial town of Lancs. on the Irwell 11 m. N.W. of Manchester. The cotton and allied industries form its staple occupation but machinery is also largely. Bury has had a long the textile

industry a Flemish colony stimulated the manufacture of woollens in the time of Edward III and this industry persists although now overshadowed by cotton. Pop. (1931) 56,000.

Bury John Bagnall (1831-1927) English classical historian, professor at Cambridge. His *History of Greece* (1900) *History of the Later Roman Empire* (1889) and edition of Gibbon are standard work.

Burying Beetles a family of carrion beetles related to the cockroaches (q.v.). They are useful as scavengers from their habit of burying small dead animals in which they lay eggs and which serve for the food of their larvae.

Bury St. Edmunds market town of W. Suffolk is a centre for agricultural produce and small and farm machinery is manufactured. A monastery was founded in the 7th cent. It is associated with the martyrdom of



Bury St. Edmunds, Suffolk. The church of St. Edmund, the patron saint of the Diocese of Ely, is one of the largest and finest in the country. It was founded in the 7th century and has been the seat of the Bishop of Ely since 1075.

(St James's) is the cathedral church of the diocese of St Edmundsbury and Ipswich Pop (1931) 16,700

**Bushbuck**, an elegant African antelope about the size of a small sheep, and related to the kudu and eland. It is frequently marked with white stripes, and the male has short spiral horns.

**Bushido** [boo'-shū-dō], rules of moral conduct for the Japanese knights and nobles, corresponding to the European laws of chivalry.

**Bushire**, port and administrative centre of Persia, on the E shore of the Gulf. The inner harbour is fairly well sheltered, and there is a busy trade, chiefly with British India. Motor transport can follow the caravan routes as far inland as Shiraz. The chief exports are dates, opium, drugs, nuts, hides, carpets, and gum. There is a wireless station, and the town is at the terminus of the overland section of the Indo-European telegraph. Pop c 20,000.

**Bushman Languages**, the family of languages spoken by the Bushmen of S Africa. They are classified into N, S, and Central groups. Their chief phonetic features are absence of the sounds *f*, *v*, and *l*, the extensive use of "clicks" (*q v*), and of consonants pronounced with a closed glottis. In grammatical structure they have many suffixes, a few infixes, but no prefixes, reduplication of word-roots plays an important part in grammatical formations, as also does the use of particles. Some of the languages distinguish the three genders, and most of them use classificatory particles to denote the general class to which objects belong (*cp* CHINESE LANGUAGE).

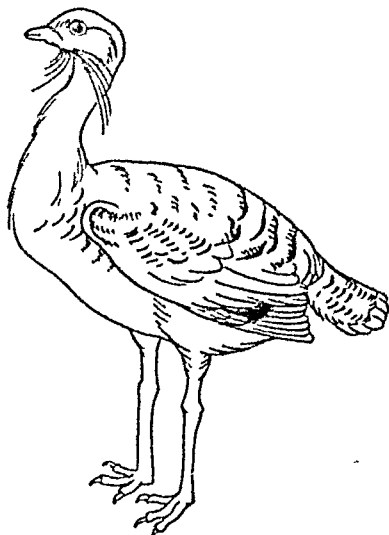
**Bushmen**, *see* AFRICA, PEOPLE OF.

**Business Cycle**, *see* TRADE CYCLE.

**Bust**, *see* ART TERMS, GLOSSARY OF.

**Bustards**, birds found in the E hemisphere, where they range from Europe to S Africa and Australia. They are related to the plovers and cranes. The best-known species is the great bustard, still found on the Continent and formerly plentiful, but

now extinct in England. Small species occurring in India are called floricans or florikins.



Bustard

**Butane**, a colourless, odourless, highly inflammable gas that is one of the naturally occurring hydrocarbons. It has a boiling-point of  $1^{\circ}\text{C}$  (normal butane) and its formula is  $\text{C}_4\text{H}_{10}$ . Butane, together with its isomer isobutane, occurs in large quantities in the natural gas found in petroleum fields, chiefly in the United States. It is separated at plants in which natural gasoline (i.e. gasoline held in suspension in natural gas) is recovered, and also at petroleum refineries.

The utilisation of butane has greatly increased in recent years, it is now employed to a large extent as a fuel both by itself and also admixed with propane. Butane is transported in the liquid state under pressure in railway tank-cars and also in smaller containers, on release of the pressure it vaporises. The butane-propane mixtures are known as "liquefied petroleum gas," and are used for enriching

town gas as a burning gas for distribution in small communities where the ordinary coal gas plant could not be economically worked and also in portable containers as a source of light and fuel in isolated dwellings not provided with a laid-on gas supply.

Butane has a much higher calorific power than coal gas and ordinary gas lights and cookers have to be specially adapted for its use.

Butcher bird, *see* SHRIKE

**Butcher's Broom**, a low shrub belonging to the lily family. It is very common in waste and bushy places especially in the S of England. The main stems are erect and green c 3 ft high and bear tiny scales which represent the leaves. In their axils flattened stems are produced having the appearance of leaves but bearing tiny greenish white flowers. The berries are scarlet and twice as large as holly berries.

**Bute John Stuart** 3rd Earl of (1713-1797) British politician received Court appointments 1750 became Privy Counsellor and King George III's adviser 1760 Prime Minister 1761 declared war on Spain 1767 and resigned office 1763.

**Bute** (1) County of S W Scotland made up of a number of islands in the Firth of Clyde of which Bute Arran and Great Cumbræ are the largest. The county is united to Renfrewshire for juridical and to Ayrshire for parliamentary purposes. Cattle are raised and the usual Scottish crops grown. The sea fisheries are well stocked with herring. The islands are an important yachting centre in summer. Area 218 sq m pop (1931) 18 800. (2) Island at the mouth of the Firth of Clyde c 40 m W of Glasgow separated from the coast of Argyllshire by the Kyles of Bute a rock bound strait c 1 m wide. It is much less mountainous than Arran two-thirds of the area is cultivable and potatoes and turnips are exported. Largsay is the principal town a water-driven cotton mill near by was the first set up in Scotland. Area c 49 sq m pop c 19 000.

**Butler Joseph** (1692-1752) divine was brought up as a Presbyterian but in 1718 became ordained in the Church of England. He became preacher at the Chapel of the Rolls and here preached his *Fifteen Sermons* which are still read to-day. In 1736 he published his *Analy of Religion*. This book on the theological side attacks the deists (q.v.) Butler is most important for his theory of ethics propounded in this book and in his sermons. He effectively combats the theory that all actions are devoted to the furtherance of self interest.

**Butler Nicholas Murray** (b 1867) President of Columbia University U.S.A. from 1902 leading authority on education founded the Teachers College of Columbia University.

**Butler Samuel** (161-1690) English poet and author of *Hudibras* a poem which follows *Don Quixote* in its general plot but in detail is widely different. It was written as a bitter satire on the anti Royalist party and contains much wit and many surprising rhymes.

**Butler Samuel** (1835-1902) English writer author of *Erewhon*. Butler was a man of wide knowledge equally proficient in biology and the classics. *Erewhon* (1854) is a satire attacking the Darwinian theory of evolution. Its title is an anagram of nowhere and it describes a kind of Utopia. Butler published important works on biology the authorship of the *Odyssey* Italian art and Shakespeare's sonnets and a novel *The Way of All Flesh* which has become recognised as one of the most original productions of early 20th-cent English literature appeared in 1903. He was also a musician and collaborated in two oratorios.

**Butler Sir William Francis** (1838-1910) British general entered the Army 1858 became lieutenant colonel 1870 and served in S Africa and Egypt from 1873 to 1879. In 1898 he was Commander in Chief in S Africa and temporarily High Commissioner but was recalled for the opinions he expressed as to the probability of war.

**Butt, Dame Clara** (b 1873), English contralto, was trained at the Royal College of Music and rose immediately into the front rank of concert singers after her debut at the Royal Albert Hall in 1892. The remarkable depth and power of her voice, combined with her capacity for singing popular music with convincing sincerity, made her one of the favourite singers of her day. She appeared in Gluck's *Orfeo* at the *Lyceum* in 1892, and again in opera at Covent Garden in 1920.

**Butt, Isaac** (1813-1879), Irish Home Rule leader, was the founder of the Home Rule League, but later became convinced that the Union with England should continue, and the League broke up.

**Butte**, mining town, and the largest urban settlement in the State of Montana, U.S.A., an important rail centre and air-port. The neighbouring mines of the Rockies supply copper, gold, zinc, silver, and lead. Silver, at one time the most valuable metal produced, has been declining during the present century. Pop (1930) 39,500.

**Butter** is a solid emulsion of water in fat, containing also other substances, such as albuminous materials, sugar, and inorganic constituents. It is manufactured from milk, an emulsion of fat in water, broken by continuous agitation, the usual practice is to allow the milk to stand till a layer rich in fat separates at the top of the liquid. It is this portion (the cream) that is churned for the manufacture of butter. Before churning it is "soured" by adding a ferment. When the churning has been completed there is obtained as a residue *buttermilk*, which is a solution of sugar and casein in water, together with a very small amount of butter-fat. The solid portion that separates on churning is butter, and this is freed from residual liquid by mechanical manipulation, a preservative, such as salt, being added if desired.

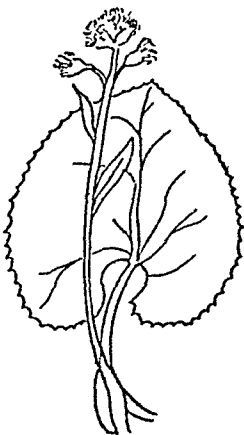
**Butter-fat**, which is not to be confused with butter, is the fat obtained by heating butter to melting-point and

removing the supernatant fat from the other constituents, cow's butter usually contains about 90 per cent of butter-fat. Butter-fat as such is not much employed in W countries, but in the E, where, owing to the hot climate, the fat free from other organic materials keeps better than the combined butter, considerable use is made of it. In India the butter-fat from buffalo's milk is separated and used under the name of *ghee*, and in Egypt and Palestine a similar substance is obtained from goat's milk and called *sanna*.

Chemically, butter-fat is of interest owing to its high content of the lower fatty acids which are volatile in steam and a considerable proportion of which (unlike the majority of fatty acids) are soluble in water. Butter analysis is a specialised branch of fat chemistry, and is of great commercial importance, owing to the fact that butter is one of the favourite substances for the attentions of the adulterator. Legal limits for the various chemical constants of butter-fat and for the composition of

butter are in force in most civilised countries. In England one of the provisions is that butter must not contain more than 16 per cent of water. See also OILS, FATS, AND WAXES.

**DAIRYING**  
**Butter-bur**, a common and most pernicious weed which produces



Butter bur

racemes of dull lilac flowers on a thick stem in March and April, followed by downy kidney-shaped leaves, 1-5 ft in

diameter which by shading the ground check the growth of all other plants

Buttercup term for several species of herbaceous mostly perennial plants of the genus *Ranunculus* found in the colder temperate regions of the Old World and introduced into America. They are characterised by yellow saucer shaped flowers and deeply divided leaves

Three species occur in Britain the bulbous buttercup erect and attaining a height of c 1 ft is the common meadow form which flowers in late spring the pale hairy buttercup an annual plant grows under similar conditions and flowers in late summer and the creeping buttercup is a trouble some weed which spreads by creeping shoots that take root wherever a leaf is produced

Butter-fat. The clear fat obtained from butter by clarification. As prepared in India it is known as *ghae*

Butterflies and Moths are insects (q v) of the order *Lepidoptera*. They normally possess two pairs of large and nearly similar wings which, like the thorax and abdomen are with rare exceptions covered with scales. The mouth, as a rule has no biting jaws but is provided with a sucking tube or proboscis formed by the maxillæ. The metamorphosis a complete. The larva is a grub or caterpillar while in the pupa or chrysalis the antennæ wings and limbs are adherent to the body

In the adult or imago stage butterflies and moths feed upon liquid food mostly obtained from flowers by means of the proboscis which is usually coiled up under the head when not in use but the larvæ having biting jaws devour solid food mostly the foliage in some cases the wood of phanerogamic plants. Many are terrible pests to farmers gardeners cotton growers etc while others which subsist on animal matter destroy fur and wool

The eggs vary considerably in shape and size. Each is contained in a shell beautifully sculptured in a variety of

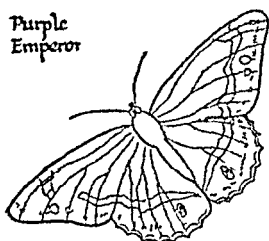
ways and provided with a small orifice through which it is fertilised. The pattern of the shells may vary greatly in species which are very similar when mature as in the common large and small tortoiseshell butterflies

The larvæ which moult several times during growth have three pairs of short legs on the thorax and on the abdomen usually five pairs of short unjointed but retractile prolegs with adhesive hooklets on the sole. When the number of prolegs is complete the movement of the caterpillar is crawling but in some species as in the Geometer or Looper moths the larva has prolegs only at the end of the body and progresses by the action known as looping. The cuticle of the caterpillar may be smooth or clothed with downy hair or bristles which as in the Tiger moth are sometimes protective by their sharp tingling points which are irritating to touch. There are many other ways however in which caterpillars otherwise defenceless and edible are saved from being eaten. Some closely resemble parts of the plant on which they feed. Geometers stretch themselves in imitation of a twig and the curiously shaped caterpillar of the Lobster moth simulates a shrivelled leaf by its attitude. Others in their general tints are like the plants they frequent green being a common colour. In this case it is probably the chlorophyll of the devoured plant that gives the tint but some experiments suggest that the colour may be due to unconscious reaction of the caterpillar to the colour of its surroundings. Many caterpillars also both of butterflies like the Swallow tail and moths are protected by possessing scent glands which emit a disagreeable odour. Others like the caterpillar of the Cinnabar moth which is distasteful are conspicuously coloured so as to be easily distinguishable

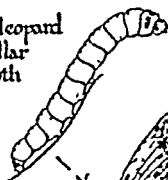
Before turning into the chrysalis or pupa the caterpillar ceases to feed and usually spins a silken case or cocoon for shelter during the resting

# BUTTERFLIES & MOTHS

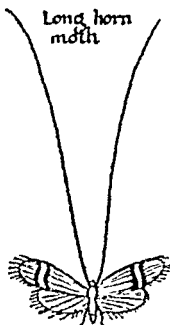
Purple  
Emperor



Wood leopard  
caterpillar  
& moth



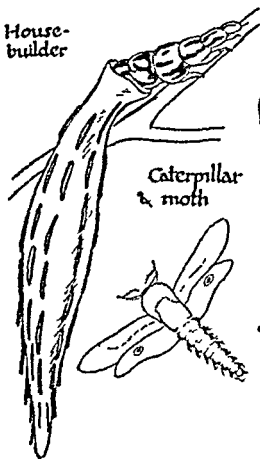
Long horn  
moth



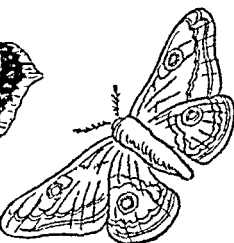
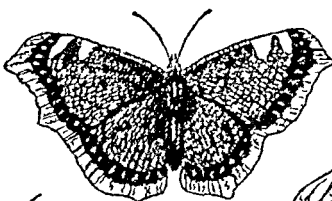
Ailanthus Moth



House-  
builder



Camberwell Beauty



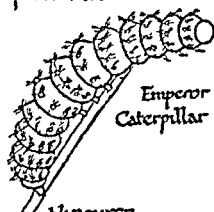
Emperor Moth

Caterpillar  
& moth



Oak Eggar moth

Emperor  
Caterpillar



Vapourer  
moth



Peacock butterfly



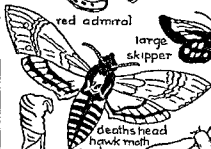
## BUTTERFLIES • MOTHS

swallow tailed  
butterflylarge garden white  
and caterpillarsilver-washed  
fritillary

red admiral



meadow brown

large  
skipperhawk  
mothdeath's head  
hawk moth  
and caterpillarhornet  
clearwing  
and  
caterpillar

ghost moth

common  
yellow  
underwinglarge white  
plume mothclothes  
moth

rosy day moth



**stage** This method is characteristic of the moths, the cocoons of the silk moths being of great commercial value. Amongst the butterflies, the skippers adopt the same habit, but in others the chrysalis is not so protected, but is attached by its tail, hanging head downwards in some sheltered spot, as in the Red Admiral and Peacock butterflies, or fastened by its tail, head upwards, to some stalk, or branch, to which it is tied by a loop of silk, as in the Purple Emperor, and the Marbled White butterflies and others. In many species, especially of the Noctuid moths, the pupæ are buried in the ground, where they spend the winter, and in the Woodborers, like the Goat and Leopard moths, they remain in the tunnels of the tree-trunks. In its final stage the pupa is usually provided with hooks, spines, or other armature



Codlin Moth

wherewith to work its way out of the cocoon, or to come to the surface if buried.

Of the many remarkable

changes the insect typically undergoes during its chrysalis stage, the most striking are, the conversion of the biting mouth-parts of the caterpillar into the sucking proboscis of the butterfly or moth, and the development of the wings. In a few small moths, however, the jaws retain their primitive biting character. In others they are greatly reduced, as in the Swifts, or absent, and in some the mouth is closed, such species taking no food.

In butterflies the wings of each side are separate, and when the insect is at rest, are raised vertically over the body and pressed close together, so that only the under side is exposed, but in most other species of the order the two wings of a side are linked together by a coupling apparatus formed of modified, often fused bristles on the hinder edge of the forewing, and the front edge of the hind wing close to the body.

In these cases, when the insect is resting, the wings are stretched sideways, or more usually folded back over the abdomen, so that the upper surface of the forewings is alone exposed.

The old classification of the Lepidoptera into the butterflies, in which the antennæ are clubbed at the end, and the moths, in which they are not clubbed, has long been abandoned, the butterflies merely forming one of the many groups into which the order is divided. The principal basis for the present classification is the arrangement of the veins of the wings, and according to this the order is divided into two main groups, the first containing those in which the venation is similar on all the wings, a small group containing amongst others the Swift moths, and the second embracing all the rest, in which the venation is different on the fore and hind wings. The details of the venation are, however, too intricate to be described here, and reference should be made to some standard work on entomology, such as A. D. Imms's *General Text-book of Entomology*.

### Buttermilk

The liquid that remains after cream has been churned into butter.

**Butterwort** is a small insectivorous plant with handsome purple flowers, and concave leaves of a texture resembling greasy parchment. The insects alighting on the greasy leaves adhere to the latter and are digested by juices which they exude, the nutrient substances being absorbed into the plant body. This power enables the butterwort to



Butterwort



Butterwort Ground Leaves

live in bogs where there is no other nitrogenous food available

Button, *see* NEEDLEWORK

Buttonhole the slit in which a button is secured A bound buttonhole can be used on almost any material Mark the slashing line (Fig 1) and tack the binding piece on the right side of the material (Fig 2) Sew firmly round the slashing line and cut as in Fig 3 Turn the binding piece through the slash to the wrong side taking particular care of the corners then arrange the binding so



Fig 1



Fig 2



Fig 3



Fig 4



Fig 5



Fig 6

Fig 7  
Buttonholes.

that it just meets in the buttonhole (Fig 4) tack down and press Then slipstitch the binding down on the wrong side A worked buttonhole can be made with round or square ends (Figs 5 and 6) The slit is tacked round three or four times This is made stronger by a band of buttonhole silk worked round the buttonhole The buttonhole is then cut and worked The correct buttonhole stitch is seen in

Fig 7 For the more usual stitch *see* BUTTONHOLE STITCH

Buttonhole Stitch, stitch made by knotting a thread over a raw edge to prevent fraying the thread connecting the stitches acting as an edging between the knotted portions of the loops It is used for scalloping and

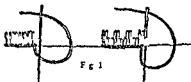


Fig 1



Fig 2

Fig 3  
Buttonhole Stitch.

for Richelieu and cut work as it bends the edges of the material and the cotton can be cut off close to the stitches (Figs 1 and 2) Another use for buttonhole stitch is in the making of tiny eyes for hook fastenings (Fig 3)

Butyl Alcohol,  $C_4H_9OH$  can occur in four isomeric modifications normal secondary tertiary and iso butyl alcohol

Normal butyl alcohol (butanol) is that most commonly met with It is manufactured principally by the bacterial fermentation of maize acetone being also formed simultaneously Normal butyl alcohol is also manufactured by the conversion of acetaldehyde (qv) to crotonaldehyde and the

hydrogenation of the latter to butyl alcohol Catalytic methods for the manufacture of butyl alcohol from carbon monoxide and hydrogen and from ethyl alcohol have also been devised

**Butyric Acid**, a liquid, one of the lower of the fatty acids (*qv*) It has a rancid odour and a boiling-point of  $162.3^{\circ}\text{C}$  It melts at  $-3.1^{\circ}\text{C}$  The formula is  $\text{C}_3\text{H}_7\text{COOH}$

In nature normal butyric acid is found in combination with other fatty acids in the mixed glycerides of butter fat, where it occurs to the extent of about 7 per cent It is also found in various animal secretions, such as sweat There is an isomer, *iso*-butyric acid, which is found either in the free or combined state in several plants Normal butyric acid is manufactured by the fermentation of carbohydrates such as starch or sugar by a special bacillus It is used in the manufacture of flavouring chemicals

**Buxar** (*Baxar*), small town in the Province of Bihar and Orissa, British India, on the right bank of the Ganges It is famous as the scene of a victory less known but hardly less remarkable than *Plassy* In 1764 Major Hector Munro, with a small force of British troops and sepoys, routed the army of Shuja-ud-Dowlah, Nawab Vizir of Oudh, and secured the English possessions in Bengal Pop *c* 10,000

**Buxton**, spa and winter sports centre, in the Peak country of Derbyshire It is said to be the highest town in England, situated *c* 1100 ft above the sea The mineral springs and warm baths were patronised by the Romans, but the great days of Buxton date from the late 18th cent The town owes much to the munificence of the Dukes of Devonshire in developing its amenities The spa is efficacious for rheumatism and nervous disorders, as well as gout Pop (1931) 15 350

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**Byron**  
**George**  
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**Baron** (1788-1846) English poet was born in London. He was

fame from birth and always sensitive about his defect. He was educated at Harrow and Trinity College Cambridge. In 1793 he succeeded to his great uncle's title.

Criticism in the *Edinburgh Review* of

his early poems called forth his first satire *English Bards and Scotch Reviewers* (1809). In this year he began the travels in S Europe and Asia Minor which are described in *Childe*



Byron. Bedroom at West Hill Abbey, N. Hants.

*His old's Pilgrimage* with which he published in 1811-18 with other poems which he had written on the tour. His fame was now assured and he became a figure in society. A number of intrigues took place especially with Lady Caroline Lamb. *The Giaour* (1813), *The Bride of Abydos* (1813) and *The Corsair* (1814) were his next publications. In 1815 he married Miss Anna Milbanke (later Baroness Wentworth) but separated from her a year later. The scandal that followed this drove him from the country and he went to Geneva where he became friendly with Shelley. His tour through Italy was productive of many poems. *Don Juan* was begun in 1818 and published from 1819 to 1846. In Venice his four years association with Teresa Countess Guiccioli involved him in Italian revolutionary movements. *Sardanapalus* and *Cain* were published in 1821 and in 1820 appeared *Werner* the only one of his dramas which succeeded as a stage play though inferior to *Manfred* or *Cain*.

In 1823 Byron who was a staunch Philhellene accepted the invitation of Prince Mavrocordato to take an active part in the Greek War of Independence. He landed at Missolonghi in Jan 1824 after an adventurous crossing from Kephallonia but his health soon gave way and on April 19 he died.



Lord Byron.

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his early poems called forth his first satire *English Bards and Scotch Reviewers* (1809) In this year he began the travels in S Europe and Asia Minor which are described in *Childe*



*Byron Bedroom at Newstead Abbey N. 113* *Harold's Pilgrimage* which he published in 1811-18 with other poems which he had written on the tour His fame was now assured and he became a figure in society A number of intrigues took place especially with Lady Caroline Lamb *The Giaour* (1813) *The Bride of Abydos* (1813) and *The Corsair* (1814) were his next publications In 1815 he married Miss Anna Milbanke (later Baroness Wentworth) but separated from her a year later The scandal that followed this drove him from the country and he went to Geneva where he became friendly with Shelley His tour through Italy was productive of many poems *Don Juan* as begun in 1818 and published from 1819 to 1824 In Venice his four years association with Teresa Countess Guiccioli involved him in Italian revolutionary movements *Sardanapalus* and *Caio* were published in 1811 and in 1819 appeared *Werner* the only one of his dramas which succeeded as a stage play though inferior to *Manfred* or *Caio*

In 1813 Byron who was a staunch Philhellene accepted the invitation of Prince Mavrocordato to take an active part in the Greek War of Independence He landed at Missolonghi in Jan 1814 after an adventurous crossing from Kephallenia but his health soon gave way and on April 19 he died

His pride, cynicism, and bitter irony did not endear him to his contemporaries, but his influence on foreign authors was very great. Victor Hugo, Lamartine, Heine, Leopardi, Pushkin, and Lermontov all revered him as their master. Although he lived in the time of the Romantic Revival, he was no romantic, but, indeed, a survival from the 18th-cent world of letters. His verse sometimes lacks beauty of expression, but he is without doubt one of England's greatest satirists.

**Byzantine Architecture** derived its name from Byzantium, or Constantinople, the seat of the E Empire, and during the 6th cent the vital centre of the arts.

The chief characteristic of the Byzantine style is found in the change from the wood-roofed basilica to the domed and vaulted church. Its most typical expression is the church of St Sophia at Constantinople (Istanbul).

The emperor Justinian resolved to make Santa Sophia the most permanent memorial of his career. His architects and workmen produced the finest and most complete example of the original Christian idea of a church—a sanctuary, or place in which the act of worship dominates everything. The church was built 532-7. It has an immense central dome surrounded by a number of lesser domes. The great problem that confronted Anthemius, the architect, was the supporting, on four arches, of this huge dome, 107 ft in diameter. The first dome of Santa Sophia fell (555), and a new one with a higher curve took its place, but in 989 this also collapsed and was rebuilt.

The interior, whose impressiveness is almost overwhelming, is a vast collection of arches and columns, the body of the church being perfectly open, and free from obstructing piers. The many arches of the interior are supported on superb columns of porphyry and marble, and the domes and vaults are covered with "gold ground mosaics." Both window and door frames are of marble.

In 1453, when the Turks captured Constantinople, St Sophia became the State mosque of the Ottoman Empire, and alterations, notably the concealing of the beautiful Christian mosaics, were begun. In 1932 the Turkish Government removed the plaster that had effectively hidden so much beauty for nearly five centuries.

To Byzantine architecture we owe the practical investigation of "domical" construction, i.e. that based on domes, and the invention of the pendentive (see ARCHITECTURAL TERMS, GLOSSARY 01). The idea of the vaulted basilican church made possible the great vaulted cathedrals of the W.

Other churches similar to St Sophia were built in Constantinople and throughout the east. The church dedicated by Theodora to the Holy Apostles, was replaced (1463-69) by the Mosque of Mohammed II, where experiments were made in lighting, the windows being placed in "vertical drums." Others included the churches of the Theotokos and of Chora, the latter eventually becoming known as the "mosaic mosque."

Apart from Constantinople there are interesting examples of Byzantine architecture at Athens, particularly the churches of St Nicodemus and St Theodore. Externally Byzantine building is picturesque, but at the same time very simple, internal beauty being stressed.

Early Arab buildings, such as the Mosque of Aksa, in Jerusalem, and the Great Mosque at Damascus (c. 710), are almost perfectly Byzantine in form, with "an added sense of energy." The Roman Catholic Cathedral at Westminster is an interesting and successful modern experiment in the Byzantine manner, with tall tower, turrets and cupola caps, and its wealth of interior decoration.

**Byzantine Art** includes the artistic production of Constantinople and the Byzantine empire from approximately the 5th to the 15th cents. It represents the Oriental development of classical and Roman art, which had

# BYZANTINE ART



The Crucifixion — mosaic



early mosaic



marble slab



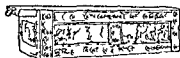
enamel—  
detail  
from a  
reliquary



ivory urn



hanging lamp of  
enamelled glass



carved  
ivory  
casket



illumination



marble  
head



themselves been affected by Christian ideology, and the course of development of Byzantine art is closely linked with that of the Christian Church. There are numerous splendid examples of Byzantine architecture, such as the Church of Santa Sophia at Constantinople, San Vitale at Ravenna and St Luke's at Delphi, and it was perhaps in architecture that the finest development of Byzantine art found expression. Mosaic and painting were used for architectural decoration, they had important influences on the early Italian painters and thus on the whole development of painting throughout modern Europe. Mosaics still exist in Santa Sophia, in the Church of St George at Salonika in Ravenna, and above all at St Mark's in Venice, which are splendid examples of the rich colouring and gilding, the formal and symmetrical treatment, the traditional symbols and types of Byzantine art. In painting, the same characteristics are evident, though the colouring is naturally quieter. Mosaic and painting were frequently combined in the same decorative scheme, the interior of domes, vaults, and walls being completely covered with the carefully planned scheme.

While architecture, mosaic, and painting flourished, sculpture declined almost out of existence, and architectural ornament developed into a kind of lattice or fret-work, with the ground deeply cut away and the surfaces often coloured or gilt.

The applied arts, ivory-carving, metal-work, enamelling, and weaving, which reached a high pitch of excellence, showed some Persian influences. Some fine examples may be seen at the Victoria and Albert Museum. Although traditional patterns and symbols were fundamental in these fields also, individuality was allowed greater play, and there was a greater freedom of handling than in Byzantine painting or mosaic.

**Byzantine Empire**, a term for the E part of the Roman Empire, whose separate existence was foreshadowed

by the foundation of Constantinople in AD 330. This term, though sanctioned by prescription, is somewhat inappropriate, since the empire as such did not come into existence till the ancient city of Byzantium, from which the name is derived, had merged its identity in the new capital. More suitable titles perhaps are Eastern Empire or East Roman Empire. It had a chequered career till 1453, when, with the fall of the city whose foundation had seen its birth, it gave up the ghost.

Two events of supreme importance mark the reign of Constantine the Great—the establishment of Christianity as the official religion, following the conversion of the Emperor, and the decision to found a second capital. The foundation of Constantinople hastened the permanent division of the Empire, which had already been tried experimentally, and the E trend in imperial policy led inevitably to the dethronement of Imperial Rome from her position as first city in the world.

While Constantine lived, E, and W, were united under his sway, but on his death in 337 the Empire was divided among his sons, one of whom, Constantius II, became sole Emperor in 363. Soon after the death of his famous cousin and successor, Julian the Apostate (361–3), the Empire was divided again. It was thereafter alternately united and divided, until the W Empire was extinguished by the deposition of Romulus Augustulus by Odoacer in 476.

The hundred years preceding the end of the W Empire had been marked by a series of Teutonic invasions, resulting in loss of territory on every side. In 378 the Visigoths (W Goths) decisively defeated the Romans at Adrianople. Under Honorius and Arcadius, the feeble sons of Theodosius the Great, the divided Empire began to disintegrate. By the end of the Theodosian dynasty (456) Rome had abandoned Britain, Gaul, and Spain. Kingdoms had been founded by the Visigoths and Burgundians in S Gaul (the rest of the province passing to the Franks), and

by the Vandals in N. Africa while Spain was shared between the Visigoths and the Suevi. The Visigoth king Alaric sacked Rome in 410 but both Romans and Goths combined to meet the Huns who were now overrunning Central Europe. The death of Attila in 453 two years after his defeat at Châlons removed this danger and the Hun Empire disintegrated into smaller kingdoms of which that of the Ostrogoths (E. Goths) was perhaps the most formidable. Not long before the W. Empire had expired its dominion hardly extended beyond the frontiers of Italy. Fortunately Persia had been quiescent since 364 and the Emperors were able to consolidate in the E. what territory had been left to them. In the reign of Zeno (474-81) Theodoric defeated Odoacer who was slain and in 493 he founded in Italy the short-lived kingdom of the Ostrogoths.

With the accession of Justinian (527-565) fortune smiled again and it looked as though the Roman Empire would regain its old frontiers. Embarking upon an ambitious plan of reconquest the Emperor was fortunate in his choice of generals. Belisarius recovered N. Africa from the Vandals in 533 as well as part of S. Spain from the Visigoths. In 535 he began the reduction of Italy completed in 554 by Narses. During all this time the Empire was in a state of war or armed truce with Persia with whom a dishonourable peace was made in 562. Germans, Slavs and Bulgarians troublesome on the N. frontier were held in check but the strain of supporting a W., an E. and a N. front simultaneously was too much for the Empire and contributed to its final collapse. Besides saddling the exchequer with the cost of his numerous wars Justinian spent enormous sums on churches and other public buildings of which the most famous is St. Sophia. Warring against unorthodoxy and paganism he not only condemned the heresy of monophysitism which had influenced his gifted wife Theodora but he closed

(529) the Philosophical Schools at Athens which had for centuries carried on the work of Plato and Aristotle. He is perhaps best known for his work in codifying and revising the amorphous body of Roman law. In spite of Justinian's Latin propensities the Empire was becoming more and more Greek and from now on it acquires a distinctly Greek orientation.

After Justinian's death (565) the effect of his ambitious policy was felt when the Empire was attacked from all sides. Italy was seized by the Lombards. The Avars, Slavs and Bulgarians invaded the Balkans penetrating as far S. as the Peloponnese. The struggle with Persia began again in 614. Jerusalem was sacked and Egypt conquered by the Persians who after threatening Constantinople in 616 were defeated at Nineveh in 627 by the Emperor Heraclius (610-41) the founder of a new dynasty. But no sooner had one enemy been driven off than two new enemies arose. The neighbours of the Byzantine Empire might be compared to the Hydra of Greek mythology.

The Saracens conquered Syria in 636, Egypt in 643, Persia between 633 and 641 and Africa between 647 and 698. Even Asia Minor was threatened. In 679 the Bulgarians founded a kingdom in Lower Moesia. Constantinople itself had to withstand critical sieges in 668-70 and in 16-18. Out of the chaos which marked the end of the Heraclian Emperors there arose the Isaurian dynasty whose founder Leo III (718-40) deserves credit for his reorganisation of the Empire though he is better remembered as an iconoclast. For the next 150 years the Emperors and the caliphs were continually at war though neither side won a spectacular victory. Meanwhile in 562 the Lombards had taken the Exarchate of Ravenna and the Franks had become a great power in the W. In 800 while Irene (797-802) the last of the Isaurians was seated on the throne of Constantinople Charlemagne was crowned Emperor at Rome inaugurating the new W.

line of Emperors, which was to last until 1806. During the 9th cent the Saracens won Crete and Sicily, and even made a temporary lodgment in S Italy.

In 867 Basil I founded the so-called Macedonian dynasty which, lasting for nearly 200 years, began by restoring the prestige and much of the ancient territory of the Empire, but ended in collapse. The power of the Saracens was broken, much territory was recovered, both in the Mediterranean and in Asia Minor, and the Saracen Empire split up into petty States. The Bulgarians, who had developed their kingdom into a formidable power, particularly under their ruler Simeon (893-927), were conquered. In 972 the Emperor John Zimisces recovered E Bulgaria, and in 1014 Basil, "the Bulgar Slayer," subdued the rest. Meanwhile, the Slavs in Greece had been brought under Byzantine rule. The Russians, who had begun to be troublesome, were side-tracked with treaties, matrimonial alliances, and conversions. The repulsive Petchenegs (or Patzinaks), who had followed the Magyars into the Balkans from the E, were held, though they were not annihilated till the battles of Lebunien in 1091 and Berrhœa in 1123. The Empire was now a first-class Power, but it was already threatened both in the E and in the W.

In the E the Seljuk Turks had replaced the Caliphs, and, taking advantage of a wave of pacifism which had overspread Asia Minor, invaded Armenia and defeated the Emperor Romanus Diogenes at Manzikert in 1071, a little before their capture of Jerusalem. Nicea fell nine years later. Nearly all Asia Minor was lost. In the W the irrepressible Normans, whose kinsmen had conquered England in 1066, made themselves masters of Sicily between 1060 and 1090. Their leader, Robert Guiscard, not satisfied with his extensive gains, led an expedition against the Empire, which was cut short by his death in the Ionian Island of Cepha-

lonia in 1085. Meanwhile, the distinction between E and W. had been emphasised by the separation of the Greek and Latin Churches in 1054.

To the throne of an Empire apparently at its last gasp there succeeded a prince of resource and ability, founder of the Comnenian dynasty. Alexius Comnenus (1081-1118) reorganised the administration, and took vigorous steps to deal with his enemies. But he was obliged to call in outside aid, for which the Empire was to pay dearly. In return for Venetian assistance against the Sicilian Normans he was constrained to make such terms that Constantinople became a commercial vassal of Venice. In return for W European help against the Seljuk Turks he let himself in for the Crusades. It needed all his tact and statesmanship to manœuvre the rough and acquisitive soldiers of the Cross, who perforce had to cross Byzantine territory, towards the professed goal of their expedition. He made good use of his unwelcome visitors; however, and recovered large tracts of Asia Minor. But the foundation in 1100 of the Latin Kingdom of Jerusalem could not be viewed with equanimity by the Byzantine Court. Nor was the ill-feeling all on one side. The westerners resented the necessary precautions taken by the Byzantine Emperor in dealing with the transit problems of the Crusade, and the antagonism between the Orthodox and Latin Churches made matters worse. It is true that plans were not wanting for the reunion of the Churches; but, while the Byzantine Emperors usually viewed such a far-reaching proposal as an object of negotiation, the Popes were inclined to regard it as an excuse for conquest. Manuel I (1143-80), who had been on good terms with Conrad III, took a leaf from the Western book after the W Emperor's death, and had vague ideas of making himself a second Justinian. But his pro-Latin views were unpopular, and his son was dethroned. In 1182 many Latins living at Constantinople were slaugh-

tered and there followed barbarous reprisals when the Normans took Salonika three years later. In the N the establishment of a second Bulgarian Empire (1186) renewed a dormant peril.

At the beginning of the 13th cent the Fourth Crusade accidentally struck the death blow of the Empire though it struggled on for another 50 years. The Crusaders led by Philip of Swabia and Boniface of Montferrat were diverted to Constantinople at the instance of Isaac Angelus who had been deposed by his brother Alexius IV. As the price of his restoration Isaac promised to help the Crusade and to further the reconciliation of the Greek and Roman Churches. He was restored in 1203 but failed to keep his side of the bargain. In 1204 the impatient Crusaders stormed the capital and divided the Empire. In its place came forth the sickly Latin empire of Romania (first ruler Baldwin of Flanders) which began to disintegrate after 10 years and disappeared in 1261. Meanwhile three independent dominions arose out of the ruins of the Byzantine empire. In Asia Minor Theodore Lascaris (1206-2) assumed the imperial sceptre at Nicaea while a descendant of the Comneni founded the State of Trebizond in N Greece one of the Angeli founded the Despotate of Epirus.

The founder of the Palæologian dynasty Michael VIII Palæologus (1259-82) partially restored the fortunes of the diminished empire capturing Constantinople in 1261. He actually effected a temporary reconciliation of the Churches in 1274 in order to further his schemes of conquest. But he had a formidable antagonist in Charles of Anjou who had captured the kingdom of the two Sicilies and was aiming at the re-establishment of the Empire of Romania. The deaths of Michael in 1282 and of Charles in 1285 averted the clash.

During the 14th cent the Bulgarian menace gave way to the Serbian. The Serbs who crushed the Bulgarians in 1330 became dominant under Stephen

Dusan threatening Constantinople from the N. In the E the Ottoman Turks were advancing in Asia Minor. The Emperor was reduced to employing a band of Spanish mercenaries known as the Catalan Grand Company whose activities influenced the history of medieval Greece. The Turks crossed into Europe in 1360 and a question of prime importance in the history of the world was shortly to be debated on the field of Kossova in 1389 when it was settled that the Turks and not the Serbs were to possess the relics of the dying Empire. The victorious Turks though temporarily checked by the Mongolian hordes of Timur (Tamerlane) who routed Bajazet I at Angora in 1402 now set about the reduction of Constantinople. The Emperor in desperate straits appealed to W Europe and induced the Pope Eugenius IV to preach a crusade of rescue. But in 1444 an allied army of Hungarians and Poles—the utmost that W Europe could manage—was defeated with great loss by Amurath II at Varna. In 1453 the last Byzantine Emperor Constantine XI Palæologus deserted by the W Powers was blockaded in Constantinople by land and by sea losing his life in the final charge of the victorious Turks. On May 30 1453 the city which had been founded as a Christian metropolis passed to the Moslems and the Byzantine Empire ceased to exist.

**Byzantine Liturgy** *see* LITURGY

**Byzantium** was originally a colony from the Greek city of Megara. It became subject to Athens in 406 B.C. and was later allied to Rome becoming a colony. Constantine (q.v.) struck with what Gibbon terms the incomparable position of Byzantium made it the seat of his government (A.D. 330) marked out its boundaries and rebuilt it. Shortly after this it was renamed Constantinople (q.v.).

**Byzantium, Siege of (323)** Constantine the Great after defeating Licinius at Hadrianopolis and at Chrysopolis brought the city to surrender and named it after himself.

## Cab

**Cab** (from the French *cabriolet*), a vehicle with two or four wheels for the conveyance of passengers, invented in Paris about 1660, and introduced for public use in London in 1823. Cabs ousted the older, heavier, and more expensive hackney-coach and in various forms have remained on city streets ever since. Horse-types include the *hansom*, or two-wheeler, with driver above, invented in 1834, and the *growler*, an adaptation of the brougham (*qv*). Both forms have been superseded by the motor taxi-cab.

**Cabal**, the name given in 1667 to the cabinet of Charles II, the initials of whose names formed the word—Clifford, Arlington, Buckingham, Ashley, and Lauderdale. Now used to mean a small party united for personal or party ends.

**Cabbage**, includes a number of green vegetables widely esteemed as articles of food, generally supposed to be descended from the wild or sea cabbage (*Brassica oleracea*), a member of the order Cruciferae, akin to the mustard, and growing wild in many places on the English coast. The wild cabbage is very like the corn mustard or charlock (*qv*), and the cultivated forms differ widely in appearance from the parent, though retaining the flowers and seed structure of the latter. They include kale, "greens," Brussels sprouts, the common cabbage, savoy, cauliflower, broccoli, and sprouting broccoli.

Common or Scotch kale is a favourite winter green vegetable, and should be sown in a rich soil early in the spring and transplanted when of sufficient size. It grows to a height of 2 ft, and its thick stem bears large reddish leaves. Resembling kale in having all the leaves open is the Jersey cabbage, which attains a height of

## C

## Cabbage Root Fly

over 8 ft, and is cultivated as an ornamental plant.

In Brussels sprouts the budding leaves are clustered into heads borne in the axils of larger leaves. It is a hardy plant, growing in any good soil, and should be sown in March, becoming fit for consumption in Nov.

Ordinary cabbages and savoy have only a terminal head of clustered leaves. They require a loamy, well-manured soil, well watered, and are sown in March, early April, and May, furnishing a supply from July to early winter, and again in the autumn, the latter plants being ready for use in the following spring. In Germany cabbages are fermented with salt to form sauerkraut, a favourite article of diet. The savoy is a cabbage with very wrinkled leaves.

Cauliflower consists of the clustered flower-buds of the plant, which form an edible white head. It was probably introduced from Cyprus. It is sown four times a year—in Feb., April, May, and Aug., and thus furnishes a supply from May to Oct. The soil should be rich, and the plant sheltered, if necessary under glass.

Broccoli is a variety of cauliflower grown in firm loamy soil, and sown in May to furnish a supply for autumn, winter, and the following spring. Broccoli sprouts are flowers springing from the axils of purple leaves, and are a very popular vegetable.

**Cabbage Butterfly**, also known as the large white, a butterfly (*qv*) whose larva feeds upon cabbages. The best method of getting rid of it in small gardens is by "hand-picking." If spraying is preferred, 1½–2 oz soap to 1 gallon of water should be used.

**Cabbage Root Fly** is a most destructive garden pest, attacking cabbages, cauliflowers, broccoli, radishes, and

turnips It attacks young plants causing their leaves to droop and change to a bluish colour Powdered naphthalene dusted around the plants is the best preventive

**Cabell, James Branch** (b 1879) American fiction writer His better known novels are *Jurgen* (1919) *The Ruet in Grandfather's Neck* (1915) and *Sons of Us* (1930) His books are mainly remarkable for their highly imaginative and even fantastic character

**Caber tossing** a Scottish athletic sport which consists in throwing a section of a tree trunk (the *caber*) 16-20 ft long so as to make it turn over in the air and land with the small end pointing directly away from the tosser The winner is adjudged on style distance and the direction in which the *caber* points after falling



Caber tossing

**Cabinet** (1) originally a small room but now used to describe a piece of furniture with either drawers or shelves designed to hold some specific article

(2) In English constitutional practice a term denoting the Ministers of the King whose policy directs the Government and who are responsible for all acts of the Crown The Ministers are invariably Privy Councilors and indeed the Cabinet developed out of the Privy Council It first began to emerge clearly in the time of Charles II whose habit it was always to consult a few confidential advisers before bringing any matter before the Privy Council but its modern form

dates from the time of William III the first king to choose his Ministers exclusively from the members of the party for the time being dominant in the House of Commons Originally the king himself presided at the meetings of the Cabinet but George I was so ignorant of English that he soon ceased to attend and the chairmanship devolved on the Prime Minister The character and functions of the Cabinet and its relation to the king and the Commons did not become fixed until the accession of Queen Victoria and they have changed little since then The chief principle is that of ministerial responsibility This means firstly that although the Cabinet is not a creature of law but of convention yet as a matter of law some Minister is responsible for every executive act of the Crown and this is ensured by the fact that every order must be countersigned by the appropriate Minister who then becomes responsible in law for its legality or otherwise Secondly as a matter of convention the Cabinet is collectively responsible to Parliament for all political actions of Ministers and for the policy of the Government as a whole This means that its decisions must be unanimous and if its policy is condemned by the Commons it must resign

It follows that the Cabinet must be appointed from the party in power and that the sovereign must act exclusively on the advice of his Cabinet tendered as a rule through the Prime Minister and he can accept no other advice The Cabinet is composed of the eight Secretaries of State the First Lord of the Treasury the Chancellor of the Exchequer and the Lord President of the Council Lord Privy Seal Lord Chancellor and First Lord of the Admiralty Practice varies in regard to the Postmaster General Minister of Transport and others The latter however though not in the Cabinet are nevertheless members of the Government as are all political Heads of Departments who are not in

Office	1916	1917	1923	1924	1925	1929	1931
Prime Minister	D Lloyd George	A Bonar Law	S Baldwin	J R MacDonald	S Baldwin	J R MacDonald	J R MacDonald
Lord President	{ Marquess Curzon J Balfour	Marq of Salisbury	Marq of Salisbury	Lord Parmoor	{ Marquess Curzon Earl of Balfour	Lord Parmoor	S Baldwin
Lord Privy Seal	{ Marquess Curzon Sir A Chamberlain	—	Viscount Cecil	J R Clynes	Marq of Salisbury	{ J H Thomas F Johnston	{ Viscount Peel S Baldwin
Exchequer	{ Sir A Chamberlain Sir R Horne	S Baldwin	{ S Baldwin N Chamberlain	P Snowden	W Churchill	P Snowden	{ P Snowden N Chamberlain
Lord Chancellor	{ Viscount Duns Earl of Birkenhead	Lord Cave	Lord Cave	Earl of Haldane	{ Lord Cave Lord Halsam	Lord Sankey	Lord Sankey
Home Secretary	{ Sir G Cave E Shortt	W C Bridgeman	W C Bridgeman	A Henderson	Sir W Joynson- Hicks	J R Clynes	{ Sir H Samuel Sir J Gilmour
War	{ Lord Derby Lord Milner	Lord Derby	Lord Derby	S Walsh	Sir L Worthing- ton Evans	T Shaw	{ Marq of Crewe Lord Halsam
Foreign Affairs	{ Sir L Worthington Evans	—	—	J R MacDonald	Sir A Chamber- lain	A Henderson	{ Lord Reading Sir J Simon
India	{ A J Balfour Lord Curzon	Lord Curzon	Lord Curzon	Lord Olivier	{ E of Birkenhead Lord Peel	W W Berrin	Sir S Hoare
Dominions	{ E S Montagu Lord Peel	Lord Peel	Lord Peel	—	L C M S Amery	{ J H Thomas Lord Passfield	J H Thomas
Colonies	—	—	—	J H Thomas	L C M S Amery	{ J H Thomas Lord Passfield	Sir P Cunliffe- Lister
Air	{ Viscount Milner W Churchill	Duke of Devonshire	Duke of Devonshire	Lord Thomson	Sir S Hoare	Lord Thomson	{ Lord Amulree Ld Londonderry
Scotland	R Munro	—	Sir S Hoare	W Adamson	Sir J Gilmour	W Adamson	{ Sir A Sinclair Sir G P Collins
Health	Sir A Mond (1918)	{ G Boscawen N Chamberlain	Sir W Joynson Hicks	J Wheatley	N Chamberlain	A Greenwood	Sir E Hilton- Young
Board of Trade	{ Sir A Stanley Sir A Geddes	Sir P Lloyd Graeme	Sir P Lloyd- Graeme	S Webb	Sir P Cunliffe- Lister	W Graham	{ Sir P Cunliffe- Lister W Runciman
Admiralty	{ Sir E Geddes W H Long	L C M S Amery	L C M S Amery	Lord Chelmsford	W C Bridgeman	A V Alexander	{ Sir A Chamber- lain Sir B Byres- Monsell
Education	H A L Fisher	E T Lindley Wood	E T Lindley Wood	Sir C Trevelyan	Lord Eustace Percy	{ Sir C Trevelyan H B Lees Smith	{ Sir D Maclean Lord Irwin
Agriculture	{ Sir A Griffith G Boscawen	Sir R Sanders	Sir R Sanders	N Buxton	{ Hon E Wood W Guinness	{ N Buxton C Addison	{ Sir I Gilmour Sir W Elliot
Labour	T J Macnamara	Sir M Barlow	Sir M Barlow	T Shaw	Sir A Steel	Miss M Bondfield	{ Sir H Bellerston Marquess of Londonderry
Works	Lord Crawford	—	Sir J L Baird	T W Jowett	{ Vice-Pres. Idery Marq of London	G Lansbury	{ W Ormsby Gore

the Cabinet and the Under Secretaries of all the Departments

The attached table shows the constitution of the various British Cabinets since the Coalition ministry of 1910

**Cabiri** [KABIRI] The a group of Greek gods who probably originated in Phœnicia Their names and number are variously recorded but they presided over obscene mysteries which are only vaguely hinted at

**Cable** George Washington (1844-1905) American author born in New Orleans the scene of many of his best works He excelled in the writing of historical romances of which the detail was obtained by patient research and in the re-creation of the spirit of pre Civil War Louisiana Among his writings were *Old Creole Days* (1890) *The G andissimes* (1880)

and *Strange Stories of Louisiana* (1889) as well as serious sociological studies such as *The Negro Question* (1890)

**Cable Electric** an apparatus for conducting a current of electricity between two places which may be hundreds or even thousands of miles apart In transmitting a telephone or telegraph message the communication cable carries a weak current of a fraction of an ampere in transmitting electric power for heating and lighting a power cable carries a far greater current up to several hundred amperes at perhaps 60 000 volts Essentially an electric cable consists of a conductor of electricity surrounded by a thin coat of insulator and finally by a protective covering which shields the cable from injury

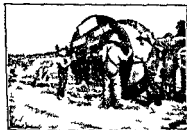
LA 15 C



Across R. H. v. B. Idg.



Laying in Ducts.



Oil-filled Cable.



Across the Nile.



**Power Cables**—The central conducting portion of a power cable consists of a number of copper wires stranded together to form a circular section, the diameter of which depends on the current and voltage, and is usually between  $\frac{1}{2}$  in and 1 in. To make the core, copper rods are pulled



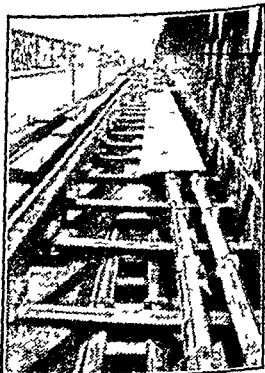
Laying Cable for Electrification of London Brighton Line

through chilled cast-steel dies and the wire annealed and stranded. The non-conductor or "insulation" surrounding the conductor may consist of rubber, varnished cambric, or paper. Rubber insulation is applied either by laying ribbons of rubber parallel to the conductor, wrapping the ribbons round it and joining the sides by pressure, or by forcing rubber bars through a die, the conductor being pulled through the centre so that the rubber is forced round it in a tube. Varnished cambric is a closely woven cotton cloth coated on both sides with insulating varnish. It is wrapped round the conductor in the form of several layers of tape. Paper is the more usual form of insulation for modern power cables. Winding machines rotate bobbins of paper tape round the conductor, and several layers are applied until the desired thickness has been obtained. The cable is heated and placed in a vacuum to remove moisture and air from the paper, and is then placed in a tank containing a hot "impregnating" compound which is some form of mineral oil, e.g. a solution of resin in resin oil or petrolatum (petroleum jelly). It remains for some time in the

hot compound before being removed and cooled. In modern high-voltage cables (33,000 volts and above) a metallised paper tape or thin metal tape is generally wound over the insulation.

The protective covering will depend on the situation and conditions of service of the cable. If wear is not likely to be heavy, silk or cotton braiding or a coating of tough rubber will be sufficient. With paper insulation a lead sheath is always employed. A hydraulic press squeezes molten lead through a circular die, the cable being fed through the centre and the lead squeezed tightly round it. Some cables are further protected by iron or steel wires separated from the lead sheath by layers of treated jute. Such wires are then covered by another coat of jute. Specially designed cables will carry up to 132,000 volts. In the "oil-filled cable" the copper conductor is hollow, and is maintained full of oil.

**Communication Cables**—These transmit telephone or telegraph messages, and operate by conducting a very weak electric current which works the telephone or telegraph indicator. Like power cables,



Cables across Wandsworth Bridge. they consist essentially of a central copper conductor, surrounded by a coat of insulation and a protective outer covering. The ordinary land telephone cable is generally laid underground in England, but abroad is often carried on poles. The submarine cable lies on the bed of a river or ocean. Land

telephone cables are made up of a large number of annealed copper wires wrapped separately with insulating paper tape  $c \frac{1}{4}$  in. wide. The manufacturing process is exactly the same as for power cables. The wires are in pairs each pair being twisted together to form one complete telephone line the electric current flowing through one wire and returning through the other. The London-Manchester trunk cable contains over 600 pairs arranged in quad formation and a cable has been constructed to contain over 1800 pairs with an outside diameter of  $c 3$  in.

**Submarine Cables**—In submarine cables the electrical impulse is transmitted along a copper core surrounded by several layers of gutta percha covered in turn by layers of oiled and tarred tapes tanned and tarred jute and then a light brass tape  $c \frac{1}{16}$  in. thick. This prevents damage by a small mollusc the teredo which bores through a cable and damages the insulation. Over the tape are wound two layers of cotton tape then more tarred jute and then one or more layers of iron wire. The whole is covered by further layers of tarred jute. A cable usually has several copper cores each of which serves as a separate channel for messages.

**BIBLIOGRAPHY** *Power Cable Insulated Electric Cables* by C. J. Beaver (1926). *High Voltage Cables* by P. Dunsheath (London 1920). *Telephone Cables The Propagation of Electric Currents in Telephone and Telegraph Conductors* by J. A. Fleming (London 1927). *Submarine Cables Submarine Telegraphy* by I. de Ciuli (London 1932).

**Cabot, John** (Giovanni Caboto) (c. 1440-1498) Italian navigator born in Genoa became a naturalised Venetian in 1476. In 1490 he settled in Bristol and his first expedition sailed from that port on May 2 1497 with letters patent issued by Henry VII and reached Cape Breton Island on June 24 of the same year. His second expedition leaving Bristol in

1498 reached the E. Coast of Greenland Baffin Land Newfoundland and Nova Scotia but had to abandon its objective which was the discovery of a route westward to Japan and Asia. Cabot died shortly after the return of this expedition to England. Some historians consider Cabot to be the actual discoverer of N. America.

**Cabot, Sebastian** (1474-1557) son of John Cabot cartographer and navigator. He explored the coast of Brazil and sailed up the Paraguay R. He was appointed Governor of the Company of Merchant Adventurers in 1551.

**Cabul**, see KABUL.

**Ca Canny** Scottish phrase meaning to go warily now used of those who deliberately work slowly in industry as a protest against some grievance. It may be regarded as a form of strike (*qv*) not entailing cessation of work.

**Cacao Beans** are the seeds of *Theobroma cacao* a tree cultivated in the British W. Indies and elsewhere. The seeds are roasted and ground for cocoa (*qv*).

**Cacao Butter** a hard vegetable fat obtained by the expression or extraction of cacao beans. The fat is extracted before the beans are employed in the manufacture of cocoa or confectionery. It is used for confectionery and for the manufacture of pharmaceutical preparations such as pessaries (see OILS, FATS AND WAXES). The spelling *cocoa* butter which is sometimes adopted is incorrect and leads to confusion with coconut oil (*qv*).

**Caceres** [pron. KATHA RĀS] (1) The second largest province in Spain is on the extreme W. about half way along the Portuguese border. Caceres is a relatively poor and backward district but owing to the large areas for pasturage and the presence of the R. Tagus it is important agriculturally and exports ham, wool and embutidos (red sausages). Area 77.5 sq. m. pop. 450,000. (2) Town capital of above a few m. S. of the Tagus. Pop. 24,000.

**Cachalot**, or sperm-whale, is a large toothed whale (*q v*), with teeth only in the lower jaw, and an immense blunt snout, at the tip of which the nostrils, or "blow-holes," open. The male is between 50 and 60 ft long, but the female only about half that length. It is a gregarious species, feeding mainly upon large cuttle-fishes, and is the most dangerous species to attack frequently, in the old whaling days, destroying the boats and occasionally sinking vessels. Since it yields spermaceti oil, which is lodged in the head, it is one of the most valuable of the whales, and the pursuit of it has greatly reduced its numbers. It is also the source of the substance known as ambergris (*q v*).

**Cachet** [*pron* KASHĀ'], *Lettre de*, document issued and signed by the Kings of France authorising the imprisonment of a person, usually in the Bastille. *Lettres de cachet* were abolished at the revolution of 1789.

**Cachucha** [KACHŪ'CHA] Spanish dance, probably of Moorish origin. It is, however, now strongly Spanish in nature, danced in 3-4 time with much clicking of castanets. The dancers whirl with increasing speed, working up to a frenzy at the end of the dance.

**Cacodyl** (chem), an organic radical containing arsenic (*q v*).

**Cactus**, a plant with succulent stems, and leaves reduced to scales. Its peculiar shape is an adaptation to the dry places in which it lives. The flowers are often large and brightly coloured, and the fruits frequently edible and pleasant to taste.

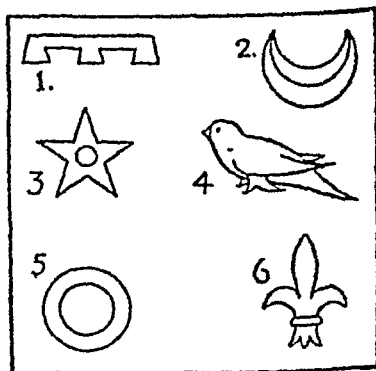
**Cadbury, George** (1839-1922), English industrial magnate, newspaper proprietor, philanthropist, and Quaker, succeeded his father as the head of the famous cocoa and chocolate firm in 1861. The business prospered exceedingly under his management and was moved to Bourneville in 1879. In 1901, Cadbury bought the *Daily News* (now *News-Chronicle*), which has ever since reflected a Liberal-Quaker point of view, and became part-owner

of the *Star* (1909). His biography was written by A. G. Gardiner in 1923.

**Caddis Fly**, a moth like insect (*q v*) of the order *Trichoptera*, of which the larvae or "caddisworms" are found in fresh water, living in tubes of silk covered with sand-grains, pieces of sticks, or particles of other kinds. Before pupation they partly close the orifice of the tube, and bite their way out when developed into the adult insect. Caddis flies are universally distributed, and mostly eat vegetable matter.

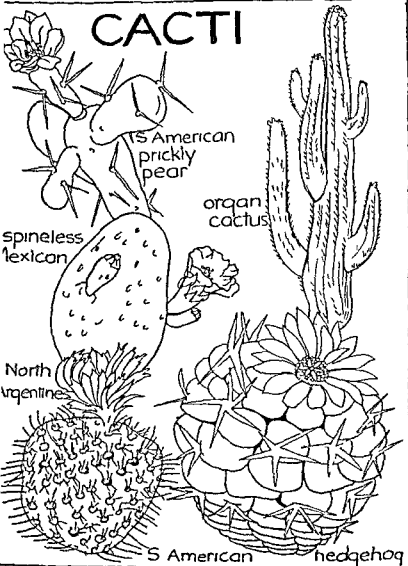
**Cade, Jack** (d. 1450), leader of the Kentish rising against excessive taxation and bad government in 1450. After a defeat of the King's troops at Sevenoaks on June 18, Cade led the insurgents to Southwark, entered London on July 3, and gained considerable support among the citizens. Terms of peace were arranged, but Cade seized the prisons of Southwark, released the prisoners, and retired to Rochester. A proclamation offering a reward for his capture was issued on July 10, trouble arose among his followers, and he escaped into Sussex. He was captured at Heathfield on July 12, severely wounded, and died the same day.

**Cadency, Marks of** (or *differences*), in heraldry, the marks by which the



Marks of Cadency

# CACTI



shields of the younger members of families are distinguished from those of the elder and from each other. There are 9 such marks. The first son bears the *label* (Fig 1), the second the *crescent* (Fig 2), the third the *mullet* (Fig 3), the fourth a *marlet* (Fig 4), the fifth an *annulet* (Fig 5), the sixth a *fleur-de-lis* (Fig 6). The process may be continued by charging, e.g. label upon label for grandsons, etc.

**Cader Idris**, mountain in Merionethshire, N Wales, with many legendary associations. The highest peak is Pen-y-Gader, 2927 ft.

**Cadet** (milit), candidate for a commission in one of the fighting services, training at a specified college. In England the military cadet colleges are the Royal Military College, Sandhurst, and the Royal Military Academy, Woolwich. The latter, known colloquially as the "Shop," specialises in training for the Royal Artillery and the Royal Engineers. The Royal Air Force College is at Cranwell, Lincs, the Royal Naval College at Dartmouth, and the Royal Naval Engineering College at Keyham (Devonport).

By extension, the term is applied to a member of the *Cadet Corps*, a movement founded in 1859 to give boys, especially at public schools, a military and patriotic training. Physical drill, musketry, signalling and other infantry activities are taught. In 1908, the Public Schools Cadet Corps became part of the Officers' Training Corps and affiliated to the Territorial Force, receiving a public grant. The grant to the Cadet Corps, of which the Prince of Wales became Colonel-in-Chief in 1922, was withdrawn in 1930, but restored again in 1932.

**Cadi**, or **Kadi** [*pron* KAHDE], a Turkish inferior judge, generally of a town or village.

**Cadiz** [KADITH'] (1) The most S and one of the richest provinces in Spain, on the Straits of Gibraltar. Celebrated for its export of sherry, Cadiz also produces salt, fish, and fruit. The climate is pleasant, and the scenery varied. Area, 2,830 sq m., pop

550,000. (2) Town, capital of the province. One of the most beautiful cities in Spain, stands on a narrow projection of land some miles N W of the Straits of Gibraltar. The town exports large quantities of sherry, salt, fish, and oil, and has an important shipping trade. Pop 77,000. It is believed to have been founded by the Phœnicians c the 11th cent B C, and became, especially under Roman rule, one of the most famous ports in Europe. The harbour, and the commanding position of the town, have always ensured its importance, and in the late 16th and early 18th cents it was extremely wealthy. It was successfully attacked by Sir Francis Drake in 1587, and completely sacked by the Earl of Essex in 1596.

**Cadmium**. For the characteristics of cadmium see ELEMENTS.

Cadmium is a metallic element which, when found in nature, is almost always associated with zinc. It is also found in an ore called greenockite, which is cadmium sulphide. It is not found in the free state. The physical properties and appearance of cadmium are very similar to those of zinc. It is used in the manufacture of fusible alloys, for dental stoppings (as the amalgam), and for electroplating, where it protects the metal on which it is deposited from corrosion, and gives it a dull but not unattractive finish. Cadmium amalgam is also used as one electrode of the Weston cell, which is the standard of electromotive force (see ELECTRICITY).

**Cadmium Compounds**. The most important compound of cadmium is the sulphide, which is used in artistic painting as a yellow pigment. When mixed with the selenide a red pigment is obtained. The tungstate is used in the manufacture of fluorescent paint. Cadmium nitrate is used for colouring glass and porcelain.

**Cadmus** (Gr mythol), brother of Europa, native, or founder, of Thebes. He married Harmonia, daughter of Aphrodite and Ares, and retired to Illyria, when he reigned as king.

Cadmus is supposed to have introduced the alphabet and was regarded as the inventor of many useful arts

**Cadorna Luigi** (1850-1918) Italian soldier. He was in command of the Italian Army during the World War until superseded by General Diaz in November 1917 after the disastrous defeat at Caporetto. He was subsequently appointed Marshal of Italy. Cadorna published *La Guerra alla Fronte Italiana* in 1911.

**Cadre** [KADRÖ] the body of permanent commissioned and non-commissioned officers forming the nucleus or framework (fr. *cadre* = frame) of a regiment or corps

**Caduceus** [KADŪSŪS] the rod carried by Mercury as a symbol of his power with two serpents entwined about it. It is the badge of the R.A.M.C.

**Cadwalader** (or *Caedwalla*) (d. 834) Welsh monarch who was engaged in several wars with Eadwine a King of Anglia. After Cadwalader's invasion of Northumbria (829) he was defeated by Eadwine but later revenged himself at Hatfield Yorks. He was slain finally in a battle near Hexham by Eadwine's nephew Oswald.

**Cæcum**, see BOWELS

**Caedmon** (d. c. 700) the first English Christian poet was a herdsman. In a dream he was commanded by an angel to sing in praise of the Creator and to his great astonishment found that he was able to compose verses with ease. The monks would read to him passages from the Bible which he after ruminating like a clean beast turned into poetry. This story is found only in Bede's history which also contains the inspired poem in praise of the Creator the only certain specimen of his gift.

**Caen**, French city capital of the department of Calvados about 30 m. S.S.W. of Havre. Its Romanesque architecture is remarkable the *Abbayes aux Hommes* (Church of St. Etienne) and *aux Dames* being important examples. The former (where he is buried) and the castle were founded by the Conqueror. The

university (15th cent.) was founded by Henry VI of England. Caen is famous for its stone of which several English cathedrals are built. Industries are lace cutlery and metal founding. Pop. 60,000.

**Caerleon** (Rom. *Castra Legionum*) City of Legions, a Monmouthshire village standing on the R. Usk a short distance N.E. of Newport. Caerleon is famous for its Roman remains which include a fortress amphitheatre streets barracks etc. It was in Roman times the seat of an archbishop.

**Caerphilly** manufacturing town in Glamorganshire about 8 m. N. of Cardiff. The ruins of Caerphilly Castle are a famous example of 14th-cent. fortification. The pop. (35,760) is mainly employed in the collieries and iron works.

**Caesar Gaius Julius** (100-44 B.C.) Roman statesman and general born of patrician parents. Although his relatives were mostly members of the senatorial party Caesar supported the popular cause. He served as a soldier in the East taking no effective part in politics. Caesar became praetor in 65 B.C. and supported Pompey against the senate. Allied with Pompey and Crassus in the Triumvirate he obtained the consulship in 61 B.C. and in 59 B.C. the governorship of Cisalpine and Transalpine Gaul and Illyria. Two insurrections were threatening one from German tribes under Arminius the other from the Helvetii. Caesar subdued these tribes in his Gallic campaign and reduced Gaul to submission. During this campaign he twice invaded Britain in 55 and 54 B.C.

His period of command ended he was ordered by the Senate to disband his army but refused and committed the unconstitutional act of leading his army across the Rubicon into Roman territory. Pompey fled to the East. Caesar was elected Consul again in 48 B.C. and overawed Rome with force. He defeated Pompey at Pharsalus the same year. In 46 B.C. quelling a mutiny under Sci-

appointed dictator for 10 years. In 45 B.C. he crushed Pompey's sons, who were raising an army in Spain. He returned to Rome, but was murdered in the senate in 44 B.C., by the extreme republicans. Caesar was a brilliant general, and also a great statesman, tempering his rule with mercy. He was the greatest of the succession of military leaders which had helped to destroy the Republic and laid the foundations of the Empire. His *Commentaries on the Gallic War* and the *Civil War* are a model of lucid Latin prose. See also ROMAN HISTORY.

**Cæsium** [*pron* 'SE'ZHUM] For the characteristics of cæsium see ELEMENTS.

Cæsium is a somewhat uncommon metal belonging to the same group of alkali metals as potassium and sodium. It occurs to a very slight extent in certain mineral waters, but its best source is a mineral, pollucite, which is a mixed silicate of aluminium and cæsium. The only application of the pure metal is as an electrode in photo-electric cells. Several cæsium compounds, for instance the carbonate and the chloride, are used in the manufacture of mineral waters.

Cæsium nitrate is used in the manufacture of electric lamps and wireless valves by being introduced into the bulb together with some magnesium powder and flashed, the combustion removes the last traces of gas remaining after the exhaustion of the bulb by pumps, and ensures the production of a high vacuum.

**Cæsura** [*pron* 'SEŠŪ'RŪ], the term applied to the failure, in quantitative verse (see ACCENT AND QUANTITY), of the end of a word to coincide with the end of a metrical foot (see VERSE). For the sake of rhythm and variety this had to occur at a stated place in each kind of classical verse. In accentual verse the cæsura is little more than the break or check in rhythm which occurs in nearly all lines, and occasionally, though not necessarily, coincides with a break in sense or grammar.

**Caffeine** [*pron* 'KAFFEN'] (*theine*, or tri-methyl-xanthine), an alkaloid found in various plants such as coffee (1.3 per cent), tea (4 per cent), and yerbamaté (*Ilex paraguayensis*) (1 per cent). Chemically it belongs to the class of purines (q.v.) and is a white crystalline substance melting at 235° C. It is manufactured synthetically from ure acid.

Caffeine has a stimulating action on the heart and brain, and is used to a considerable extent in medicine. It is also a powerful diuretic. See also ALKALOIDS.

**Caftan**, garment worn in the East by persons of both sexes. It is a kind of tunic, belted at the waist, with long sleeves.

**Cagliari** [*pron* 'KALYAHRI'], a province and town in the S. of Sardinia. Lead and zinc mining are the staple industries. The town, the capital of the island, stands on the Gulf of Cagliari on the S. coast; it is of very early origin and has been occupied by Vandals, Romans, and Saracens. The Cathedral is of the 12th cent., and St Saturnin's Church of the 8th century. Exports are lead, zinc, and salt. Pop. 57,000.

**Cagliostro, Alessandro, Count** (1743-1795), Italian charlatan, who posed as an alchemist. His real name was Giuseppe Balsamo. He travelled in the East and through Europe, selling love-philtres and elixirs of youth. He was very successful, and made large profits. Finally he was imprisoned in Rome in 1789 as a heretic, and died in prison. For a full account of his life and adventures see Carlyle's *Miscellanies*.

**Cahors**, a historic French city 65 m. N. of Toulouse. It possesses several fine old buildings, the Cathedral (12th cent.), St Ursicse (13th cent.), the Maison d'Henri IV, and the remains of the Palace of Pope John XXII. Cahors has a famous bridge, the Pont Valentré, a fine example of a 14th-century fortification. Local products are wine, fruit, and tanning. Pop. 11,000.

**Caiicos and Turks Islands**, a group

lying between the Bahamas and Haiti. They are under the Government of Jamaica and consist of about 30 small islands 8 of which are inhabited. The total area is just over 160 sq m and the products are salt sponges and turtle-shell. Pop 5500.

**Caillaux, Joseph Marie Auguste** (b 1863) Fr statesman. He was M of Finance 1899-190 again 1906-8 and 1913. He became Premier in 1911 but resigned over the Morocco negotiations in 1912. His wife was arrested for the murder of the editor of *Figaro* but was released. Caillaux was suspected of defeatism during the War, tried in 1919 for plotting against the state and condemned to 3 years imprisonment and loss of civic rights but released the next day. He was again Minister of Finance in 1915 and 1916 for brief periods.

**Caiman** (*Cayman*) group of three small islands in the Caribbean W N W of Jamaica of which they are a dependency. The islands are Grand Caiman, Little Caiman and Cauman Brac. They produce timber and coconuts and have valuable phosphate deposits. Discovered by Columbus who named them Tortuga from the great number of turtles found there. Pop 6182.

**Caiman** see ALLIGATOR.

**Caine** Sir Thos Henry Hall (1853-1931) Manx novelist and dramatist. He was educated as an architect but later joined the journalistic staff of the *Liverpool Mercury*. His novels of the melodramatic school included *The Shadow of a Crime* (1882), *The Decisive* (1887), *The Manxman* (1894), *The Eternal City* (1901) and *The Prodigal Son* (1904). Some have been dramatized.

**Cainozoic** a geological term for the period covered from the Eocene (qv) to the present time thus including the Tertiary and Quaternary epochs (qv). Sometimes it is taken as equivalent to the Tertiary alone. The former is perhaps the better sense in which to employ the term since the whole of geological time can then be grouped in

three great divisions the Palaeozoic, Mesozoic and Cainozoic.

**Caird** Edward (1835-1908) British theologian and philosopher was born at Greenock. He was appointed Professor of Moral Philosophy at Glasgow in 1866 and Master of Balliol in 1893. He may be considered the founder of a school of orthodox neo-Hegelianism in Britain. He published *Critical Philosophy of Kant* in 1889, *Evolution of Religion* in 1893 and numerous other works on religion and philosophy.

**Cairn** a conical heap of stones erected as a landmark or especially in ancient times as a monument to some dead person. In Scotland up till quite recently cairns were made where a coffin of a distinguished person halted on its way to the churchyard. Memorial cairns are erected even at the present time. In the Middle Ages cairns sometimes served the secondary purpose of marking boundaries.

**Cairngorm**, see QUARTZ.

**Cairo** [pron KAIRŌ] (Fr *Le Caire*) capital of Egypt stands on the Nile 120 m S S E of Alexandria and c 100 m S S W of Port Said. The city is built partly in the river valley and partly on the slopes of the Mokattam Hills. It falls into two natural parts, the old city established since the 10th cent and the new which has grown up under W influence and contains the Government offices, business houses, hotels and European residences.

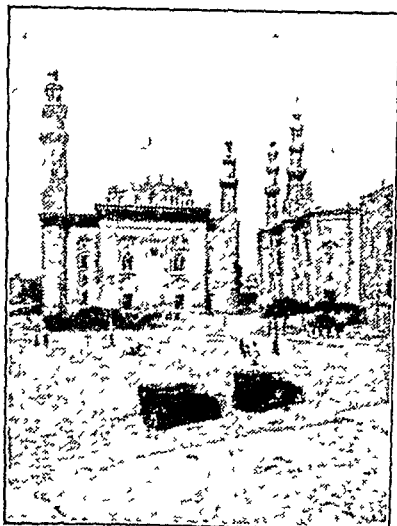
The Oriental part of the city is remarkable for its beautiful architecture, its thronging native life and its picturesque quaintness. The mosques are a notable feature there being more than 200 in the city. Some are as celebrated for their historical associations as for their beauty. Among the most important are the *Khalun*, *Sultan Hassan*, *Tulun*, *El Hassan* and *El Azhar*, the latter having for many years past been the largest Mohammedan seminary. Near the town are the remains of the Roman fortress of Babylon and the island of Roda opposite the old town is said to be the



place where Pharaoh's daughter found Moses. Beyond the walls are the famous tombs of the Mamelukes. At Heliopolis, near by, is a great international aerodrome.

The city is inhabited by many different races. Europeans of various nationalities, Arabs, Nubians, and Jews, and also the native Cairenes. The death-rate was formerly high owing to the very insanitary conditions, but Cairo is now regarded as a healthy place. There is a very large transit trade, and the bazaars and markets are always busy. Flax, sugar, cotton, tobacco, sheep, machinery, hardware, and woollens are among the commodities handled, the locality produces cotton, sugar, and paper.

Cairo is the fourth Mohammedan capital of Egypt, of the earlier three, one was built on the same site, and the other two a short distance to the S. The present city dates from A.D. 968.



Cairo Sultan Hassan Mosque and Mohammed Ali Square

and was named El Kāhira (the Victorious), whence arose the modern

name. It was conquered by the Turks in 1517, by the French in 1798, and



Cairo The Citadel

reconquered by the Turks and British in 1801. Pop. c. 1,000,000.

**Caisson**, strong water-tight compartment, open at one end, and used in civil engineering for working under water. In one form it is used inverted as a diving-bell, water being forced out of it by compressed air, enabling men to work in it at considerable depths below the surface of the water. In other cases it is allowed to rest on a solid foundation, often many feet below a stratum of mud, and after the men have withdrawn the caisson is filled with concrete and becomes an integral part of the structure.

**Caisson Disease**, fatal malady formerly attacking divers and men working in caissons. They had to work surrounded by air at a pressure greater than that of the surrounding water, and therefore much greater than atmospheric. This pressure in itself is not harmful, but under its influence considerable amounts of gases (nitrogen particularly) dissolve in the body fluids. If, now, the pressure be suddenly released, as when the diver returns to the surface, these gases are liberated as bubbles, which obstruct the working of the internal organs.

It has been found that if the pressure is released gradually (*de-compression*) the gases are liberated gradually, and can be removed by the action of heart and lungs. Thus

caisson disease is now rare and divers experience no ill-effects from the great pressures to which they have been subjected.

**Calithness**, the most N F county of Scotland bounded by the Pentland Firth on the N and by Sutherland on the S and W. The coast is bare and rocky and includes the promontories *Duncansby Holburn* and *Dunnet* the extreme N headland. There is excellent

creamd with the sugar sponge cakes contain no fat at all the sugar and eggs being beaten together gingerbreads belong to a class by themselves for although the amount of fat should classify them under the plain cake mixtures the inclusion of syrup or treacle in the recipes makes a different method of mixing necessary.

The average composition of these cake mixtures is as follows

	Plain Or	Rich Or	Sponge Or	Gingerbread Or
Flour	8	6	9½	13
Baking powder	1 tea spoonful	½ (1 small cube if gits used)	Pinch	Bi. bo. 1 ½ t a poon 1
Fat	2-4	6-8	—	4
Sugar	2-4	6-8	3	4
Milk	Sufficient to make of soft dropping consistency	—	—	Syrup or treacle ½ ½ gill
Eggs	1 egg	3-5 eggs	2 eggs	2 eggs
Fruit	4-6	8 or more	—	2-4

salmon fishing in the *Thurso* and round the coasts. For the most part the land is barren and hard but oats and turnips are produced. The wool of the district is of fine quality. Fishing especially the herring fishery is a staple industry beyond this and quarrying for flag stones there is little production. The area is about 700 sq m. Pop. 28 000.

**Cajamarca** (1) Department of Peru well watered and temperate cattle raising is the chief occupation. The Andes cross it and coal and silver are found in *Hualgayoc*. Area 1 500 sq m. pop. 500 000. (2) Capital of the department it has sulphur springs and ruins of the Inca *Atahualpa's* palace. Woollen and linen goods are manufactured. Pop. 14 000.

**Cake-making** The many recipes for cakes can be reduced to one or two model forms. The quantity of fat determines the richness of cakes. Plain cakes contain a little fat which is rubbed into the flour. Rich cakes contain varying amounts of fat the quantity equalling from half to the whole of that of the flour and this is

### Methods of Mixing

(1) Cut fat into the flour with two knives rub in with the tips of the fingers. Continue until it is like breadcrumbs.

(2) Soften butter or margarine by standing in a warm place. Beat with a wooden spoon and add castor sugar. Continue beating until like whipped cream in consistency.

(3) Beat eggs with a wire whisk usually over hot water in order to hasten the process of thickening. When sufficiently beaten the mixture of egg and sugar should hold the impression of the whisk for a few seconds after lifting it from the mixture. Eggs should always be broken separately into a cup before adding to others in cake mixture in order to discard bad ones.

(4) Beat whites of eggs with a clean knife on a clean plate or in a basin with a wire whisk. A mechanical beater is quicker but tends to break down the albumen. A pinch of salt aids in the whipping. A white is considered stiffly whipped when the plate or basin which contains it can be inverted without its falling off.

(5) In preparing fruit, etc., for cakes, rub *currants and sultanas* with a little dry flour on top of sieve, or wash in strainer and dry in clean cloth to remove stalks, remove hard sugar from *glacé fruit* or *angelica*, wash in hot water, dry, and roll in flour, place *almonds and pistachio nuts* in boiling water, strain, remove skins, and put in cold water, before drying.

(6) Tins used for the baking of fruit cakes are usually lined with paper. Modern tins, with removable bottoms, require greasing only for ordinary fruit cake. Undue browning is prevented by protecting the outside with 2 or 3 layers of paper.

(7) Cut a strip of paper rather more than 3 times the diameter of tin and 2 or 3 in. above the edge, and a round to fit the bottom. Fold over about 1 in. of strip, and cut slanting gashes about  $\frac{1}{2}$  in. apart. Grease strip, and fit in tin, eliminating any creases, and arrange greased circle on this.

(8) In preparing a tin for sponge cakes, grease slightly, and sieve equal quantities of sugar and flour (or rice flour) in tin, shaking out any excess.

(9) For *Swiss rolls, etc.*, lay tin on greaseproof paper, mark corners, and cut an oblong or square about  $1\frac{1}{2}$  in. wider all round than the tin. Fold over edges, so that paper is the same size as the tin. Grease tin, put paper in it, smoothing away all creases, and neatening corners.

(10) Paper cases require no greasing. Care should be taken, however, not to distort the shape in pulling them out or by placing them too near to each other on the tin.

(11) Tins for scones and rock cakes should be greased and dusted with flour, any excess being shaken off.

(12) For the temperature of ovens, see COOKING.

(13) Tests to show that cakes are done are as follows.

*Fruit cake* A hot skewer inserted in centre of cake should come out clean. The centre when pressed should feel firm.

*Sponge cake* should spring back when

pressed, and shrink from the sides of the tin.

(14) Allow cakes to stand a minute or two in order to shrink slightly, then turn out on to sieve or wire tray.

The following are typical cake recipes.

### Lunch Cake

- 6 oz. flour
- 2 rice flour
- 1 teaspoonful mixed spice
- 3 oz. butter or margarine or lard
- 3 oz. sugar
- 5 oz. fruit (currants, sultanas, peel)
- 1 egg
- $1\frac{1}{2}$  teaspoonfuls baking powder
- $\frac{1}{2}$ –1 gill milk to mix

Sieve flour, rice flour, spice, and baking powder. Rub in fat. Add sugar and fruit. Bind with beaten egg, and sufficient milk to make of a soft dropping consistency. Bake in a moderate oven (350° F.) for  $1\frac{1}{2}$ –2 hours.

### Christmas Cake

- 1 lb. flour
- $\frac{3}{4}$  lb. castor sugar
- $\frac{3}{4}$  lb. butter
- 2 lb. currants
- $1\frac{1}{2}$  lb. sultanas
- $\frac{1}{2}$  lb. peel
- 6 oz. almonds (sweet)
- 6 oz. cherries
- $\frac{1}{2}$  teaspoonful ground cinnamon
- 1 dessertspoonful mixed spice
- 8 eggs
- Salt

### Lemon juice

Cream sugar and butter. Beat in each egg separately, sieving in flour between each one. Stir in dry ingredients, lemon juice, and a little milk if necessary. Bake in a moderate oven (320° F.) 3–4 hours.

**Calabash**, a W. Indian and S. American tree of the order *Bignoniaceæ*. The hard outer covering of its fruit, which resembles a gourd (*qv*), is used as a vessel, and is so tough and hard that it can be used for cooking. The name "calabash" has been adopted for similar vessels made from other material.



som for their fellow-citizens In 1558 the Duke of Guise captured the town from the English It was their last stronghold in France, and its loss caused Queen Mary to exclaim on her death-bed, 10 months later, that "Calais" would be found engraven on her heart During the World War Calais was an important British base

**Calamine**, a naturally occurring zinc carbonate,  $\text{ZnCO}_3$ , found in Germany and the United States, in the latter country it is also known as *smithsonite* and *hemimorphite* It is used as a pigment in the painting of pottery *Electric calamine*, which is also found in the United States, is a zinc silicate

**Calamite**, a fossil plant found in coal, with jointed stems similar to those of modern horsetails, but attaining a great size The nodes bore whorls of branches with compound leaves, and large and small spores

**Calcareous Algæ**, see ALGÆ

**Calceolaria**, named from Lat *calceolus*, "slipper," in reference to the shape of the flower Bright-coloured herbaceous plants for border, conservatory, and greenhouse They can be grown from seed sown in July, on clean, sandy loam, and maintained through the winter in a cold frame, or propagated by cuttings taken during the autumn

**Calcite**, a form of calcium carbonate, usually found as crystals, granular masses, incrustations, or stalactites

Calcite is the second most abundant mineral, over 300 forms having been described The two commonest crystalline forms are "dog-tooth spar," consisting of sharp elongated crystals, and "nail-head spar," where the crystals terminate in tabular herds "Iceland spar" is a variety of rhombohedral shape, which has the property of double refraction, so that an object viewed through it appears double "Satin spar" is a compact fibrous variety exhibiting a satin-like lustre Stalactites are icicle-like masses hanging from the roofs of caves, or in other places through which water carrying lime in solution can percolate As the

water evaporates it deposits part of the lime and gradually builds up a column, while where it drips on the floor below a similar column rises as a stalagmite

Oriental alabaster and Algerian onyx are banded stalagmitic varieties used to make ointment jars by the ancients.

At Matlock, and other places where the water is highly charged with lime, it is possible to encrust objects with a deposit known as calcareous tufa, by leaving them immersed in the water of the spring This tufa is often called travertine

Calcite is also present in solution in sea-water, and many animals and a few plants withdraw it to make their shell or skeleton These shells fall to the bottom, and may bulk largely in a future deposit The chalk, for instance, consists largely of the remains of microscopic organisms called Foraminifera

The purer kinds of calcium carbonate provide lime, the less pure yield cement Marbles and crystalline limestones are much used for building, while Iceland spar is used for the manufacture of optical lenses The mineral is also of use as a flux in smelting It is almost universal in distribution

**Calcium**. For the characteristics of calcium see the article ELEMENTS

Calcium is a metallic element belonging to the group known as the rare earths It is not found free in nature, but in combination it is extremely widely distributed The most important calcium mineral is the carbonate,  $\text{CaCO}_3$ , which is to be found in the form of limestone, marble, chalk, dolomite, etc The latter is a double carbonate of calcium and magnesium Calcium is also found as the sulphate (gypsum) and as the phosphate

Metallic calcium is prepared industrially by electrolysis of a fused mixture of calcium chloride and calcium fluoride It is a silvery metal, somewhat similar to tin, and is used for alloying with lead to harden the latter and in steel castings The use for the

latter purpose is due to the great ability of calcium to absorb air and other gases when heated thus improving the quality of the casting

**Calcium Compounds** The most important compound of calcium from the industrial point of view is the oxide  $\text{CaO}$  more commonly known as *lime*. This is prepared in enormous quantities in limekilns by the strong heating of limestone or chalk whereby the carbonate is decomposed by the removal of carbon dioxide leaving lime (quicklime). Lime as such is employed for the manufacture of refractories since it is extremely resistant to heat when raised to white heat it gives out an intense white light known as lime light this was once extensively used in theatres but has now been almost entirely superseded by various types of electrical projectors

By far the most important employment of lime however is in the form of slaked lime. This is calcium hydroxide  $\text{Ca(OH)}_2$  and is prepared by mixing lime with water the reaction being accompanied by the evolution of a large amount of heat. Slaked lime is used in the manufacture of *mortar* which is a mixture of slaked lime sand and water. Slaked lime is also employed in the manufacture of cement (*qv*) for the clarification of liquids such as sugar solutions and sewage and for a number of reactions in chemical industry

**Plaster of Paris** is obtained by heating hydrated calcium sulphate  $\text{CaSO}_4 \cdot \frac{1}{2} \text{H}_2\text{O}$  (*gypsum*) to form the hemihydrate  $\text{CaSO}_4 \cdot \frac{1}{2} \text{H}_2\text{O}$ . On mixing this latter with water it sets again to the hard hydrated form of the sulphate. Since expansion accompanies this setting the plaster is used for obtaining casts from moulds

**Bleaching powder** is chloride of lime  $\text{CaOCl}_2 \cdot \text{H}_2\text{O}$  and is manufactured by passing chlorine into dry slaked lime. It is used as its name implies for the bleaching of various materials such as textiles and paper pulp. Its action is due to the liberation from it of free chlorine in the presence of a weak acid

Calcium sulphide in the commercial form (i.e. containing slight impurities) exhibits phosphorescence after exposure to sunlight and is used in the manufacture of luminous paints. The tungstate is also employed for this purpose

Calcium carbide is used for the manufacture of acetylene (*qv*) and the phosphate is an important constituent of superphosphate (*see* BONE PRODUCTS)

Calcium phosphide (Photophor) on contact with water generates an impure hydrogen phosphide that immediately takes fire in the air. It is therefore used as a flare for lifebuoys and in marine flares for night use

**Hydrolyth** is calcium hydride. On mixing it with water hydrogen is generated and it is employed in generating gas for filling balloons. It is however expensive

**Calc Spar** a type of naturally occurring calcium carbonate. It is also known as *calcite* (*qv*) and when occurring in a very clear crystalline form as  *Iceland spar*. This latter mineral is much used in manufacturing optical lenses

**Calculating Machine** All kinds of arithmetical and mathematical operations being performed by strict rule there is no theoretical reason why any of them should not be performed by mechanical methods. All arithmetical operations of adding subtracting multiplying and dividing can be performed by positive mechanical devices which give a result independent of any accuracy of construction in the machine apart from that necessary for the mechanical working of the various parts. In another class of calculating machine exemplified by the *slide rule* the result is obtained by reading on a scale or by examining a curve traced by a pen on paper the accuracy being relative not absolute

The first calculating machine was invented by Blaise Pascal (*qv*) in 1642. This was an adding machine and was based like many subsequent machines of the present

to laws which remain unaltered when transferred from one system of co-ordinates to another, and is thus of importance in connection with the theory of relativity which deals with fundamental laws of universal application

**Calcutta**, a city of N E India, the capital of Bengal presidency, lies on the Hugh R about 80 m from the coast. It is one of the wealthiest and most important cities, and was until 1912 the capital of British India. Its geographical position is a commanding one, as ships drawing up to nearly 30 ft of water can ascend the river, and it is a great railway terminus. Quantities of goods from the valleys of the Ganges and the Brahmaputra are taken to Calcutta, and its commerce is of paramount value. It exports jute, tea, raw cotton, rice, and raw silk, and imports for the whole of the neighbouring parts of India hardware, cotton goods, wines, etc. Modern Calcutta is a beautiful city, and among its show places are the Maidan, a great park with a race track, cricket grounds, and many famous statues, the Botanical Gardens, the University, Government House, and the Victoria Memorial. There are about 1½ million inhabitants, among whom Hindus predominate, with a large number of Mohammedans, and a much smaller British community.

Calcutta was founded by Job Charnock of the East India Company in 1690. Fort William was built in 1696, and the city was captured by Suraj-ud Dowlah in 1756, when the tragedy of the "Black Hole" took place. 146 European prisoners were forced into a small guardroom, where all but 23 were suffocated, it was paved with black marble, 1902. Calcutta was recaptured by Colonel Clive and Admiral Watson in the next year, when modern Calcutta may be said to have arisen. In 1912 the seat of the Supreme Government was moved to Delhi.

**Caldecott, Randolph** (1846-1886), English artist, noted chiefly for his illustrations to children's books, such

as *John Gilpin* and *The Great Panjandrum Himself*.

**Calderon de la Barca, Pedro** (1600-1681), the greatest Spanish dramatist. His work is remarkable for the perfection of its stage-craft, for a high level of poetic diction, and for a more than Shakespearean indifference to unessential facts of geography and history. Of his 120 plays, 80 autos, and 20 shorter interludes, etc., it is only possible to indicate the nature of one or two of the most famous. *The Mayor of Zalamea* (*El Alcalde de Zalamea*) is a moving vindication of the domestic rights of the poor. *The Fairy Lady* (*La Dama Duende*) is a scintillating "cloak-and-sword" drama of intrigue. *Physician of his own Honour* (*Medico de su Honra*) enshrines the terrible conventions which in Calderon's time governed the outcome of unfortunate love. *Magico Prodigioso* had certainly considerable influence upon Goethe's *Faust*, it contains some of Calderon's finest lyric poetry, part of which was translated by Shelley. *Love greater than Death* (*Amar despues de la Muerte*) and *No Monster like Jealousy* (*El Mayor Monstruo los Zelos*) are two great tragedies. Of his autos, the best known, and probably the best, is *The Divine Orpheus*.

Archbishop Trench and Edward Fitzgerald were among the best English critics and translators of Calderon.

**Caledonian Canal**, a canal about 60 m in length, made by artificially connecting Lochs Lochy, Oich, and Ness. It goes from Loch Linnhe, opposite the island of Mull, to Inverness Firth, and saves fishing and pleasure vessels the dangerous passage round N. Scotland. It was surveyed by James Watt, and constructed by Telford. Opened in 1822, but not completed till 1847.

**Calendar**, a system of dividing and measuring time. It involves the fixing of some definite era or point of time as a basis for reckoning (e.g. the Birth of Christ), and then the division of time into convenient periods. These periods have, from earliest times, been

taken from astronomical observation. The most essential are the year, the month and the day. A year is the period of time taken by the earth to complete one circuit round the sun. A lunar month is the period taken by the moon to complete one circuit round the earth. A day is the period taken by the earth to complete one revolution upon its own axis. But none of these periods is capable of convenient measurement in integral figures. A solar year consists of 365 days 5 hours 48 minutes 46 seconds, a period inconvenient in itself but doubly so if divided into months. A lunar month consists of 29 53058 days and 1<sup>st</sup> of these give only just over 354 days—11 days short of the solar year. Thus the year cannot be divided into an equal number of days or months without an increasing accumulation of error, and the history of the various calendars that have been constructed is largely that of different attempts to reconcile the discrepancy between the solar year and the lunar year of 12 lunar months.

The calendars of ancient Greece and republican Rome were based upon a year that was both solar and lunar; that is, an attempt was made to associate the beginning of each year with a particular position of the sun and that of each month with the new moon. This necessitated the periodic intercalation of extra months to make up the difference between lunar and solar years. The result in the case of Rome was such an accumulation of error that in 46 B.C. Julius Caesar had to make a year of 445 days as a prelude to the introduction of his reformed calendar. The Julian and the Gregorian Calendars divided the year of 365 days into 12 calendar months (as distinct from lunar months) of as nearly equal length as was practicable and compensated for the fact that the year is actually slightly more than 365 days by introducing an intercalary day every fourth or leap year.

Characteristics of the most import

ant calendars (from a European point of view) are as follows:

**Roman Calendar.** The era from which the years were reckoned was the foundation of Rome 753 B.C. in Christian reckoning. The year was originally divided into 10 months starting from March and ending with Dec. and this left c. 60 days unaccounted for. Very early in Roman history the months of Jan. and Feb. were added to the end of the year. These were lunar months and had the effect already referred to. The months were not divided into weeks but there were three fixed days in each: the *Kalends*, the first day of each month; the *Ides*, the middle day which fell on the 1<sup>st</sup> of March, May, July and Oct. and on the 13<sup>th</sup> of the other months; and the *Nones*, the 8<sup>th</sup> day before the Ides. Reckoning inclusively, e.g. either the 7<sup>th</sup> or the 5<sup>th</sup> day of the month. All remaining days of the month were reckoned as the 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, etc. day before whichever of the three fixed days next followed, always inclusively. Thus June 10 was reckoned as *a d* 12 *Kal* *Quint*, the 1<sup>st</sup> day before the *Kalends* of July (*Quintilis*).

**Julian Calendar.** This was a reform introduced by Julius Caesar in 46 B.C. He kept the era of the foundation of Rome and the former system of counting the days of the months but substituted solar for lunar months and thus abolished the intercalary months which had been much abused by pontiffs and magistrates. The mean length of the year was taken as 365½ days and this was preserved by the alternation of three years of 365 and one of 366 days. The extra day in each fourth year was obtained by counting the 6<sup>th</sup> day before the *Kalends* of March (Feb. 24) twice (*see* **BISSEXTILE**). This calendar was later adopted by the whole of Christendom and remained in use in countries of the Greek Orthodox faith until early in the 20<sup>th</sup> cent. The chief changes were the renaming of the months *Quintilis* and *Sextilis* as July and Aug. the



substitution of the Christian era for that of the foundation of Rome, and the division of the months into weeks

**Gregorian Calendar** The one defect in the otherwise almost perfect Julian calendar arose from the Julian mean year of 365½ days being longer than the mean solar year by 11 minutes 14 seconds. This meant that the date of the vernal equinox, March 25 in Caesar's time, had, by 1582, moved back to March 11. In this year Pope Gregory XIII issued a bull to restore the correct date of the equinox by reckoning Oct 5th in that year as the 15th, and to maintain this correction by not reckoning the century years (those ending in 00) as leap years unless they were exactly divisible by 400. Thus, 1600 was a leap year, 1700, 1800, 1900 were not, and 2000 will be. This calendar was at once adopted by Spain, Portugal, France, and parts of Italy. Protestant countries were slower to accept it, it was introduced into Scotland in 1600, into the greater part of Germany towards the end of the 17th cent, and into England in 1752, when the mob went about crying, "Give us back our eleven days!" believing their lives had been shortened by that period.

Russia, and other countries of the E Orthodox communion, did not accept the reform until after the World War. See also JEWISH CALENDAR, MOHAMMEDAN CALENDAR

**Calgary**, Canadian city in Alberta province, about 40 m E of the Rocky Mountains. Calgary is rapidly growing, and its trade with it. It lies in a large agricultural district, and its industries include corn mills and iron foundries. Coal is supplied from mines in the Rocky Mountains, and the city stands on the Canadian Pacific Railway. The Prince of Wales owns a ranch in the neighbourhood. Pop 65,300

**Calicut**, a city on the W coast of India, Malabar district, which gave its name to calico. Portuguese explorers and merchants realised its possibilities,

but found it difficult to treat with the natives. In 1792 it became a British possession. Produces coconuts, coffee, tea, etc. Pop. 82,300

**California**, second largest State of the U S A, and one of the richest and most important, lies along the Pacific coast, bounded on the N by Oregon, and on the S by Lower California. Its area is c 158,300 sq m, and its pop over 5,000,000

There are two mountain ranges, the



California Road cut through a Giant Redwood Tree

coast range, and, parallel with it on the E border of the State, the Sierra Nevada, the two ranges join at their N and S extremities, and so enclose a great valley more than 18,000 sq m in extent. To the N of the valley is a rough, broken country, the W part of which is very wet and well timbered, to the S of it lies a great arid expanse, including the Mohave Desert. The valley is well watered by the San Joaquin, Sacramento, and Feather Rivers. In the hot season melted

snow from the mountain peaks replenishes the irrigation channels. The climate is mild with but small variation between winter and summer there is a fair amount of rain especially in the mountains and N. of the valley. The principal peak of the Sierra is Mount Whitney over 14 000 ft. in height the range which is famous for its magnificent scenery varies from 5000 to 14 000 ft. Disastrous earthquakes occurred in 181° 1868 187° and 1906 and one of some seriousness in 1933.

California is rich in mineral products manufactures and agriculture. The chief mineral is gold of which c. 10 million dollars worth annually is still produced other mineral products are copper silver lead and boron. California has great agricultural resources and produces an abundance of fruit including oranges grapes peaches and lemons. Fishing is a minor but important industry and the manufactures include petrol refining from the valuable oil wells of the State lumber fruit preserving and film production for which Hollywood is the centre. Railway and shipping facilities are good large sums having been spent in recent years to improve all forms of transport.

The chief towns are Los Angeles San Francisco Oakland and Sacramento. Among educational institutions are 3 universities and the Lick Observatory at Mount Hamilton.

The Constitution was framed by the Labour Party in 1880. The Governor is elected every 4 years there are two Houses the Senate (40 members) and the assembly (80 members) elected for 4 and 2 years respectively.

California was discovered in the 16th cent. and was first occupied by Spanish settlers and missionaries. The area became part of Mexico in 182° but after a period of discontent was taken over by the U.S.A. in 1848 becoming a State of the Union in 1850.

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Gulf of California. The country is mainly unfertile and suffers from great lack of rain and irrigation. Agriculture especially cotton growing is carried on in the N. There is a considerable pearl fishery centring round La Paz the chief town and minerals including copper iron and silver are produced. Lower California is a part of the Mexican Republic. Area 58 300 sq. m. pop. 94 500.

California Poppy a hardy annual flowering freely and flourishing in any soil. Colours are crimson rose orange and lemon.

Caligula, Gaius Caesar Augustus Germanicus (A.D. 1°-41) 3rd Emperor of Rome 37-41 succeeded Tiberius whose adopted grandson he was. He was the son of Germanicus and Agrippina. After his accession he governed wisely modifying some of the worst tyrannies of Tiberius but after a severe illness he became brutalised and outdid his predecessors in savagery and vice and in the degree of idolatry he demanded for himself. He was finally assassinated.

Caliphs [Arabic successor] Moslem rulers successors of Mohammed. After the death of Mohammed there were four Caliphs of Medina later Arabia and Syria were conquered under the leadership of the Omayyad house which retained the Caliphate until the middle of the 8th cent. in spite of the opposition of the descendants of the older Caliphs of Medina the Aids. The rise of Iraq to greater importance in the Moslem world and the rivalry of the Omayyad and Aids Houses led to the victory of the Abbasids who became Caliphs of Bagdad the dynasty lasting until the Turkish Conquest of Bagdad 1258. Under the Caliphs the power of Islam reached its apex. During this period Caliphates were set up in Africa and Spain the former under a dynasty known as the Aghlabites and the latter under the house of Omayyad. After the Turkish destruction of the Bagdad caliphate the title was assumed by the Turkish sultans and held by them.

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until the establishment of the Turkish republic under Kemal Pasha (1922). The abolition of the Turkish Sultanate after the World War raised the question of the succession to the Caliphate. Moslem tradition enjoins that the Caliph should be a sovereign ruler possessed of temporal power. In the Mohammedan world the claims of the King of Egypt, the King of Iraq, and the King of the Hejaz and Nejd have been successively mooted, but no definite step has yet been taken to fix the succession. The question of the Caliphate was raised at an All-Moslem Conference in Jerusalem, 1931, but no decision was reached.

**Calixtus** (or *Callistus*), name of 3 popes

**CALIXTUS I**, pope from c 218 to 222

**CALIXTUS II**, pope from 1119 to 1124. He was chosen at Cluny and displaced Gregory VIII, the anti-pope in Rome. Calixtus excommunicated Gregory and the emperor Henry V in 1119, but in 1122 he became reconciled to the emperor (see **WORMS, CONCORDAT OF**).

**CALIXTUS III**, pope from 1455 to 1458. He was a Spaniard, named Alphonso de Borgia, a close friend of Alphonso V, King of Aragon, who secured his appointment, and uncle of Alexander VI. During his reign Joan of Arc was rehabilitated.

**Calla**, see **ARUM**

**Callao**, the principal seaport of Peru, situated about 7 m S of Lima. It has excellent docks and harbour facilities, and exports minerals, hides, sugar, etc. It was destroyed in 1846 by an earthquake. Pop 55,000.

**Calles**, Plutarco Elías (b 1877), President of Mexico, 1924-8. He was active in the revolution against Porfirio Diaz (q v), and in 1913 fought in the army of Carranza against President Huerta.

He was the Labour Party candidate when elected to the presidency in 1924. During his term of office conflict with the U.S. petroleum interests arose, followed by strife between State and Church.

**Calligraphy** [*pron* KŪLĪ'GRŪFI], in the strict sense, means beautiful writing, and hence handwriting in general. Styles of handwriting have varied from the severely upright and plain, to the intricately complicated writing of clerks and lawyers, the purpose of which was to prevent forgery, but particular styles are characteristic of particular periods. Ancient handwriting is known as **PALÆOGRAPHY** (q v). For the development of modern handwriting see **WRITING**.

**Callimachus** (c 310-240 B C), Greek poet and scholar, chief librarian of the Alexandrian library. Only a few of his hymns, epigrams, and fragments are extant.

**Callope** [KALĪ'ŌPI], one of the nine Muses, mother of Orpheus, presided over epic poetry and oratory.

**Callisthenes** [*pron* KALLIS'THENĒZ] (c 360-328 B C), Greek historian and pupil of Aristotle, accompanied Alexander the Great on his expedition into Asia. For his criticisms of the emperor he was accused of conspiracy, and died in prison.

**Callitris** (*bot*), a genus of coniferous trees allied to *Thuja*, the hard wood of which is used for the floors and ceilings of mosques, because of its durability. The Clanwilliam Cedar (S African) is most valuable.

**Call Money**, funds lent by banks and subject to immediate repayment by the borrower when "called" by the lender. The rate of interest charged for such loans is always lower than for loans for specified periods or even loans recallable after specified "short notice." See also **BANKING AND CREDIT**.

**Callot, Jacques** (1592-1635), French engraver, born at Nancy, worked under the patronage of Cosimo II at Florence and of Louis XIII of France, and was renowned throughout France and Italy. His best-known plates are those known as *The Fairs*, *The Miseries of War*, and *The Temptation of St Anthony*.

**Calmar**, see **KALMAR**

**Calmuck**, see **KALMUK**

**Calomel**, the popular name for mercurous chloride  $Hg_2Cl_2$ . It is used medicinally as a purgative (see **MERCURY**).

**Calorie** [*from* **KALORI**] the metric unit of heat (*qv*) defined as the quantity of heat necessary to raise 1 gramme of water 1° C in temperature at 16° C. The kilogramme-calorie or large calorie is 1000 times as great 1 cal = 4.18 joules (watt-seconds). The British Thermal Unit is 25 calories.

**Caloric Value of Food** the proportion of calories (*qv*) or heating units in a given quantity of food. Fats starchy foods or proteins produce heat and energy which can be measured. The amount produced from equal weights of various substances varies according to the group. Thus 1 grain of protein yields 4.1 kilogram-calories (written calories) 1 grain fat yields 9.3 calories and 1 grain carbohydrate yields 4.1 calories. The day's supply must be derived from fats proteins carbohydrates in their correct proportions (see under respective headings) and must contain the necessary amount of vitamins roughage and mineral salts.

There are 100 calories in each of the following:  $\frac{1}{2}$  oz cheese 1 oz honey  $\frac{1}{2}$  oz cooked bacon 1 oz uncooked sausage  $1\frac{1}{2}$  oz bread 1 oz rolled oats 4 oz steamed cod steak 1 oz flour 1 oz butter 10 oz grapefruit and 8 oz carrots.

**Calorising** see **CORROSION**.

**Calpurnia**, daughter of L. Calpurnius Piso Roman Consul in 58 B.C. She married Julius Caesar in 59 B.C. and is supposed to have foreseen his murder but in spite of her warnings and entreaties he proceeded to the Senate House and to his death (44 B.C.).

**Calumet**, see **RED INDIANS**.

**Calvados**, coastal department in N.W. France including among other towns Caen Honfleur Lisieux and Bayeux. Calvados is over 2000 sq. m. in extent and has a population of about 400,000. Chief industries are cotton wool weaving agriculture and cider.

the liqueur Calvados made from apples is famous.

**Calvary** the name given to the hill outside Jerusalem where Jesus Christ was crucified. The name (*Calvaria*) signifies a skull and is possibly founded on the shape of the hill. The name is also applied to sculptured groups representing the Crucifixion.

**Calvé Emma** (b. 1866) operatic soprano the greatest of all *Carmens*. She was born in the S. of France and studied under Marchesi. She made her début in Brussels in 1888.

**Calverley Chas Stuart** (1831-1884) English poet and parodist won the Chancellor's prize for Latin verse while at Balliol in 1851. Following an undergraduate escapade he went to Christ's College Cambridge winning the Chancellor's prize there also. His light humorous verse is best exemplified in his *Verses and Translations* (1860) and *Fly Leaves* (1872).

**Calvin John** (1509-1564) famous theologian and reformer founder of an important branch of the Protestant religion. Born at Noyon in Picardy he was appointed to a Roman Catholic chaplaincy at 19. At 18 he became curate at St. Martin de Marteville and later at Pont L'Évêque having greatly distinguished himself in his theological studies in Paris. Notwithstanding his prospects in the Roman Catholic Church Calvin left Paris in 1528 to begin the study of law and Greek at Orleans and Bourges which he continued until his father's death in 1531. There was considerable dissatisfaction in France at that time with the immorality and corruption rife in the Church and the teachings of Luther were influencing a growing body of opinion. Calvin appears to have definitely associated himself with the Protestants in 1532 and 1533 and to have decided at this time to devote himself to the propagation of the pure doctrine. But the forces of orthodoxy were becoming alarmed and when Calvin's friend Nicholas Cop then rector of the University of Paris preached a sermon in defence of

Protestantism and of the doctrine of justification by faith alone, the storm broke, and Cop was compelled to fly to Basle. Calvin, who was also implicated, escaped from Paris, but was arrested in 1534. He was released immediately, as there was no sufficient charge against him.

He had definitely decided to abandon the Roman Catholic Church, had resigned from his ecclesiastical positions, and at Portiers in 1534 had celebrated the first communion service held by the French Evangelical Church. Compelled to leave France for his safety, he travelled to Basle later to Geneva, where he remained almost continuously until his death.



John Calvin

#### Confession of Faith

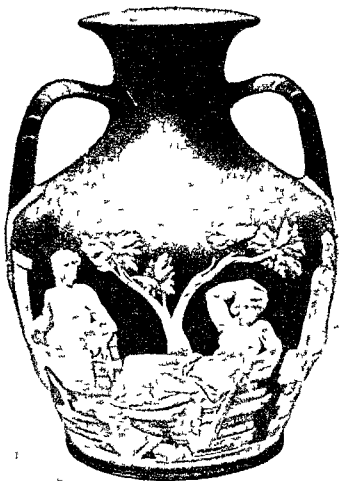
Calvin worked indefatigably in combating all the perversions of Protestantism common at this time, and in establishing an educational system culminating in the foundation of Geneva University. His death at 55 can be attributed to the austerity of his life, and his untiring labours on behalf of his faith. He published a number of theological works in Latin and in French, including *Institutes of the Christian Religion*, a statement of Protestant faith appearing in 1536.

**Calvinism**, the teaching of John Calvin, it has influenced bodies of Christians other than those who claim to be Calvinistic. His teaching, even more than Luther's, epitomised the Reformation, and gave both Huguenots

and English Puritans their driving force. Seventeenth-century Calvinism stressed the doctrine of Predestination, and the relationship of the individual with God. Calvin's teaching, that some "elect" are predestined to salvation while others must be damned, was essential to his belief in the infinite power and knowledge of God and the salvation of fallen men by faith. God chooses some for salvation and through Christ they acquire the necessary faith and achieve the remission of their sins. The individual obtains salvation through Divine mercy, not through the Church. While Calvin taught that the power of the Church was great, as it was both spiritual and civil ruler, and while he believed in two Sacraments, Baptism and the Lord's Supper, he held that Salvation was individual, the elect being chosen by God, not the Church, and their election shown in the holiness of their lives. They could not escape the results of their sins by Papal dispensation. Many of these doctrines have since become liberalised by so-called Calvinists, who dislike the harsh logic of Calvin's teaching.

establishing the foundations of his church and organising the religious, and to some extent the civic life of the people of Geneva and other Swiss towns. It was here he drew up the Protestant

**Calvinistic Methodist Church**, a Welsh Christian denomination, originating in the Methodist revival of the 18th century. At first the Welsh Methodists did not separate from the Church of England, though they later adhered to the Methodist Connexion. In 1823 the Calvinistic Methodists published their own Confession of Faith, based on the Methodist Confession and in 1826 articles of their constitution were drawn up. They are a body of Christians holding Calvinist doctrine (see CALVIN), but not rigidly. Their government is a compromise between Congregationalism and Presbyterianism. The members are nationalist in sentiment, and play an important part in education and other public affairs. The body is one of the most influential religious bodies in Wales, and is conspicuous for its support of national cultural movements, e.g. the Eisteddfod.



CERAMICS THE PORTLAND VASE





CERAMICS THE MUSIC LESSON  
(Chelsea Porcelain Group)

**Calydon** [κάλυδών] an Ætolian city founded by Calydon the son of Ætolus. A famous Greek myth tells how a boar sent by Artemis to devastate the country was hunted and slain by Meleager.

**Calypso** [KALIPSO] one of the Oceanides or daughters of Atlas. She detained Ulysses for 7 years on her island of Ogygia and when he left she died of grief.

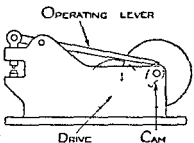
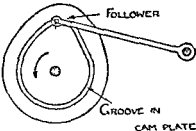
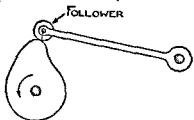
**Calyx** the outer leaves of a flower. The sepals are called collectively the *calyx*. They are usually green but may be coloured in flowers such as anemone in which the petals are absent. Their chief function is to protect the petals and the reproductive organs.

**Cam**, English river upon which Cambridge stands, known formerly as the Granta. It is 40 m in length, rises near Ashwell and flows through Cambridgeshire to join the Ouse near Ely.

**Cam**, a plate of metal in a machine made to move in a manner which controls the motion of a piece called the *follower* which presses against its edge. Cams are of the most varied shapes for they are used only when it is necessary to give some part of a machine a peculiar motion which can not be obtained by the linkage of levers or similar devices. The cam is usually rotated and the follower very frequently consists of a pivoted arm having at its free end a roller which rests on the edge of the cam. By suitably shaping the cam many types of motion can be given to the lever. The follower is pressed against the cam either by a spring or by gravity. If the cam is required to drive in both directions it may be made in the form of a groove, thus making the use of a spring to hold the follower against the cam unnecessary. A special case is where the cam consists of a straight or curved slot in a piece of metal and the follower is a pin at the end of a rotating arm.

One very common use is where a quick return motion is required as

in a punch. Here there is a slow steady forward motion of the punch in which it does its work then a quick return followed by a pause in which the workman can place a fresh piece of metal in position. Thus



C in A lion.

motion cannot be given by levers geared directly to the drive. Cams are also used on internal combustion engines for operating the valves, enabling a rapid opening of the valve, its maintenance open for any desired time and its rapid closing. The chief

disadvantage is that the force between cam and follower is usually irregular, resulting in irregular wear and consequent change in the shape of the cam, but suitable design may overcome this in part

**Camaldolese**, members of a religious Order, also called Camaldulians, founded in 1010 by St Romuald of Ravenna, a Benedictine monk. The rules of the Order were very strict, including silence and abstention from meat, but the severity of the rules were relaxed in 1102. The Order has now only a few members, in Italy.

**Camargo, Marie Anne de Cupis de** (1710-1770), ballet dancer, daughter of a Spanish dancing master, born in Brussels. Her first appearance in Paris, in 1726, brought her tremendous success. She had a considerable and distinguished following, including many of the French nobility, among her admirers. The Camargo Ballet Society in England was named after her.

**Cambay**, an Indian State to the N of Bombay, about 350 sq m in extent. Wheat and cotton are produced, but the district is not important. The capital, Cambay, was once prosperous, as is testified by its ruins, but the growth of Surat has caused its decline. Pop. state, 72,000, town, 27,000.

**Camberwell Beauty**, a handsome but rare British butterfly, related to the tortoiseshells. Its rich brown wings have a yellow edge and a row of blue spots. Its caterpillar feeds on birch and willow.

**Cambodia**, a district lying W of the Gulf of Siam, with Cochun-China as its S boundary, and Siam as its N. Cambodia is part of French Indo-China, and its king is under the protection of the French Government, its foreign policy is managed by the French President-in-Chief, as are the Customs and the Exchequer. The great lake of Tonlé Sap which is fed by the R Mekong supports a large fishing industry, and is an important reservoir for the agricultural districts. Rice is the staple crop, but tobacco,

maize, cotton, and tea also are produced. The climate, which shows little variation in temperature, is determined by the monsoons, the wet season is April-October. The dominant religion is Buddhism, there are many ruins which show that Cambodia was once a prosperous district. The European population is small, but the natives, mainly Cambodians, with some Chinese and Malays, number about 2,800,000. Area, 67,500 sq m.

**Cambon, Jules Martin** (b 1845), brother of Pierre Paul Cambon and, like him, in the French diplomatic service. It was largely owing to his reports from Berlin, where he was Ambassador, 1907-14, that France was prepared for the outbreak of the World War. He was elected President of the Council of Ambassadors in 1920.

**Cambon, Pierre Paul** (1843-1924), French diplomat, Ambassador in London from 1898-1920. He helped to promote the Entente Cordiale, and was a member of the French Académie des Sciences.

**Cambrai**, a French town in the Nord department, 20 m N of St Quentin, and about 12 m S of Douai. Cambrai has been known since the 6th cent AD, its Roman name being *Camaracum*. Its manufactures are mainly cambric, wool spinning, beet sugar. It is well known as the site of two important battles in the World War. Pop. 25,000.

**Cambrai, Battle of** (Nov 20-Dec 5, 1917), an indecisive battle of the World War resulting in a slight gain of territory by the Allied armies. The battle was begun by a British advance which for the first time employed tanks in mass. It was at first strikingly successful, but the Germans were able to prevent the Allies breaking right through, and on Nov 23 replied with a counter-attack that penetrated the British line. The counter-attack was repulsed. The effect of the battle was to relieve the pressure on Italy.

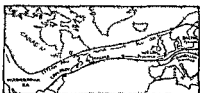
**Cambrai, Peace of** (1520) between Francis I of France and the Emperor Charles V, by which France abandoned

Italy to the Emperor and relinquished her claim to Flanders and Artois Her title to the duchy of Burgundy was recognised

Cambrion System, the term applied to the oldest group of rocks at least in Great Britain which contain definite fossils The name is derived from their extensive development in Wales The deposits throughout the different areas are remarkably similar They are mostly grits quartzites and conglomerates with sometimes thick masses of limestone and especially in Wales a few volcanic outpourings

The fossils found in the Cambrion deposits show a surprisingly high degree of organisation for so early a fauna and it is now regarded as practically certain that they are merely the descendants of forms less highly evolved which have not yet been discovered possibly because the beds containing them have been denuded away or because the fossils themselves had no hard skeletal structures capable of being preserved With the exception of the vertebrates every important large group of animals alive to-day was represented in this Cambrion fauna The deposits are divided into three groups Lower Middle and Upper each characterised by a particular fossil a species of trilobite (q v) In Great Britain the Cambrion includes more beds than it does on the

Continent where the equivalent of our uppermost Cambrion is placed in the next system the Ordovician



The Cambrion System (the Will)

The Cambrion of Great Britain occurs mainly in Wales the Midlands and the N.W. Highland and the fossils found in the last mentioned district show a marked difference from those characteristic of the two former

This difference in the fossils is seen in many other parts of the world and the Cambrion fauna is divided into two groups the Atlantic and the Pacific The Atlantic fauna is characteristic of the extreme E. of Canada Wales the English Midlands Scandinavia Czechoslovakia Spain Portugal Sardinia an area near the Dead Sea and Siberia the Pacific fauna is found in

TABLE OF SUCCSSION OF CAMBRIAN STRATA IN GREAT BRITAIN

Succession.	N Wales	S Wales	Shropsh	N. easton	Mal vms	N.W. High-lands
Passage Beds	Tremadoc lates		Shinet hales	Mare le hal	Bro l shales	
Upper Cambrion (characteristi fossil Olonius)	L. gula flags	L. ngula flag	Orussa shales	Oldbury shales	White- l ed oak hales	Durness limestone
Middl Cambrion (char t rist fossil Paradoxides)	M. evia l ten Upper H lech beds	Men sa l ten Solva series	Lppe Com l y series	Parley hales		
Lower Cambrion (characteri fossil Olonius)	Lower Har lech beds	Carl l series	Low Com ley seri Wrekin quartzite	H rt hill quartzit	Hollybush sandston Malvern quartzite	Serpentit grt " Furoid beds Basal quartz ites and grits

the Appalachian and Cordilleran Mountains of the United States, the N W Highlands of Scotland, Manchuria, China, India, Australia, and Tasmania. So doubtless there were two separate seas, covering respectively the areas mentioned, but themselves divided into a number of smaller seas, as is indicated by the different faunas found in China and India, and Australia.

**Cambridge:** (1) County town of Cambridgeshire, on the R Cam. It is the seat of a world-famous university (see CAMBRIDGE UNIVERSITY), and possesses much fine architecture. It was formerly an important trading centre and river port, and the Stourbridge fair at Barnwell near by was one of the greatest in the country. Two churches of great architectural interest are St Benet's, and the Holy Sepulchre, and Cambridge Castle (no longer standing) was built by William the Conqueror. The views from the river, which backs on a number of the finest colleges, are famous. Cambridge was once known as Grantabridge, from the Granta, the old name for the Cam. Nowadays, apart from the university activities, the town is a considerable agricultural and railway centre, and has a good metal-founding industry. Pop (1931) 66,803.

(2) American city in Massachusetts across the Charles R from Boston. It has been an important cultural centre since the foundation of Harvard University, and the associated Radcliffe College for women. There are, besides, a number of other educational institutions. The town has many historical and literary associations: the first American troops in the War of Independence set out from here, and among those who have lived in Cambridge at different times are Longfellow, Russell Lowell, and Oliver Wendell Holmes.

The town is a large industrial centre, machinery, rubber, foodstuffs, and soap are manufactured, and iron-founding is carried on. Pop (1930) 113,600.

**Cambridge, George Francis Hugh** (b 1895), 2nd Marquess of, Earl of Eltham, Viscount Northallerton, was born in London. He held a commission in the 1st Life Guards, and succeeded to his father's title in 1927.

**Cambridge, George William Frederick Charles, Duke of** (1819-1904), Commander-in-Chief of the British Army, and a cousin of Queen Victoria. He was born in Hanover, and served for a short period with the Hanoverian Army. In 1837 he was given the rank of Colonel in the British Army. He served at Gibraltar and in Ireland and at all the great battles of the Crimean War. He succeeded his father in the dukedom in 1850, and was appointed Commander-in-Chief in 1856, resigning in 1895.

**Cambridgeshire**, a county of E England, bounded on the N by Lincolnshire, S by Essex and Hertford, W by Bedfordshire and Huntingdonshire, and E by Norfolk and Suffolk. Most of the county is in the fen district, and the countryside is flat and uninteresting, the only elevations are the Gog-Magog hills, and the hill upon which Ely stands. A large chalk area covers the S and E districts, to the SW clay and greensand take its place, and the rest of the county is alluvial fenland. The principal rivers are the Ouse and the Nen, which flow largely through artificially constructed channels. Agriculture is the mainstay of the county, Cambridgeshire being one of the biggest grain areas in England. Potatoes and sugar-beet are also produced, and dairy farming is important. There are no manufactures of note.

Cambridgeshire was occupied in Neolithic times, but it was the Romans who raised the county, and in particular the town of Cambridge, to importance. The Danes held it in the 10th cent, and long after their expulsion Ely was a storm-centre of political and ecclesiastical strife. Cambridgeshire is rich in architecture, possessing rare examples of the Norman style, as well as the cathedral of Ely, and the

chapels and colleges of Cambridge University. The area excluding the Isle of Ely which has a separate local administration is 315 168 acres pop 140 004

**Cambridge University** one of the two great historical universities of England

The Mediaeval university was not the collection of splendid colleges that exists to-day. The first buildings used were certain detached houses. In 1284 a plot of ground was given to the teaching authorities on which was built some years later a School of Theology. From time to time other plots were donated and buildings added until by the end of the 15th

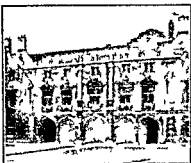


Cambridge King College

cent a quadrangular structure was completed which after many changes is now almost wholly appropriated to the University Library.

During the 13th cent. the formative period of the University both teacher and scholar lived where they pleased. The first step was to provide the teachers with board and lodging; this was the beginning of the collegiate system. Attention was then paid to the students; the Senate combining with leading townsmen to see that the men in lodgings were not overcharged. But not until after the establishment of a number of hostels or boarding houses in which the undergraduates could live together with a master in charge were arrangements concluded for

receiving within the College precincts those who had not yet graduated. Some colleges are named after generous benefactors and a site was usually



Cambridge Peppys Library Magdalene College

selected on which there already stood a house sufficiently commodious to contain the beneficiaries of the Foundation.

Examinations at first were entirely oral. A degree was merely a licence to teach and it was only those who proposed to act tutorially who proceeded to it. In the 16th cent. the founding of professorships began. After the Reformation college lectures were developed and a system of private tuition initiated. The evolution of subjects and studies at Cambridge from an over-emphasis on the theological school in mediaeval days to



Cambridge Trinity College

the modern urge for science in its manifold branches is of considerable interest. Many changes have also come about in the life of the

who originally slept in charge of a senior, in a common room the corners of which were curtained off for study during the day

The development of college buildings was the result of experience the first quadrangle, "deliberately designed" as such, was at Corpus, the "courts" at Peterhouse, the oldest foundation, were a matter of slow growth. The first "deliberate" college chapel, fully licensed—for religious needs—was that of Pembroke (1355), but the most noble architectural achievement at Cambridge during the Middle Ages is King's Chapel. There are fine classical gateways at Caius. There is also the Elizabethan timbered President's gallery at Queens', and at Clare relics of Continental Renaissance influence. The Chapel at Emmanuel, and Trinity Library, reflect the splendour of Wren. For the finest examples of early 17th-cent Gothic, the Chapel at Peterhouse and St John's Library should suffice. Peterhouse (1284) is the oldest foundation, followed by Clare (1326), Pembroke (1317), Gonville and Caius (1348), Trinity Hall (1350), Corpus Christi (1352), King's (1441), Queens' (1448), St Catherine's (1473), Jesus (1496), Christ's (1505), St John's (1511), Magdalene (1543), Trinity (1546), Emmanuel (1584), Sidney Sussex (1590) and Downing (1800). Other organisations are Selwyn College (1882) and the body of non-Collegiate students (1869), also two colleges for women students—Girton (1873), and Newnham (1875). The average number of men "up" each year is c 5000, and they "keep" three terms—Lent, Easter, and Michaelmas. There are 60 professors, of whom 6 are Regius professors, 5 of these professorships having been founded as early as 1540, and the subjects are Divinity, Greek, Hebrew, Physic, Civil Law, and Modern History.

In 1880 the Council of the Senate appointed three representatives to the governing body of Girton, the first official recognition of its existence on the part of the University. A year

later women students were admitted to the examinations in honours of the University, though they are still unable to proceed to a degree.

The Statutes of 1926 admitted qualified women to teaching offices in the University and to membership of the faculties.

Among other new "Chairs" founded are those dealing with "Industrial Relations," "Music" and "Naval History." In 1928, the Rockefeller Foundation gave £700,000 to the University. Among the latest buildings of note the new Royal Society's Mond Physical Laboratory for advanced experiments in atomic research marks a definite departure from the mediæval in style.

Cambridge University returns two members to Parliament.

See A Hamilton Thompson, *Cambridge and its Colleges*.

**Cambuskenneth**, a historic abbey, founded (1147) by David I, a short distance from Stirling, Scotland. In 1864 the remains of James III (d 1488) and his queen were discovered there. A Scottish Parliament met at Cambuskenneth in 1320.

**Cambyses**, son of Cyrus the Great, and King of Babylonia from c 528–521 B.C. Cambyses was successful in conquering Egypt, but his expeditions against Ethiopia and Carthage met with failure. An account of his exploits is given in the History of Herodotus.

**Camden**: Town on the River Delaware, in New Jersey, U.S.A. A wealthy manufacturing port, produces ships, gramophones, pins, linoleum, woollen goods, and chemicals. Pop 125,000.

**Camden, Charles Pratt**, 1st Earl (1714–1794), Lord Chancellor of England. Earl Camden was a valiant defender of the rights of the English people, particularly in connection with the laws of libel, and a champion of the American colonists in their fight against unjust taxation. This, together with his defence of John Wilkes against the Government, forced his

resignation of the Chancellorship which he held from 1766-70

**Camden, Battle of** (American War of Independence) (1) Aug 18 1780 the British (4000) under Lord Cornwallis gained a complete victory over a greatly superior force of Americans under Gates and De Kalb (who was killed) It is also known as the battle of Sanders Creek (?) See HOBKIRK'S HILL.

**Camel**, a large hump-backed cud-chewing animal differing from typical Ruminants (*q v*) by having teeth in the fore part of the upper jaw and a three-chambered stomach and by the two toes of the feet being provided with nail like hoofs and broad soft soles for walking on sand

There are two species the bactrian or two-humped camel an inhabitant of Central Asia and the one humped camel or dromedary which originated in Arabia or N. Africa Both species have been domesticated for



Camel

generations and apparently no genuine wild camels remain some so-called wild bactrian camels being probably the descendants of escaped tamed specimens From time immemorial camels have been of inestimable value to the nomad tribes which domesticated them on account of their adaptation to desert life unsuitable for cattle and horses which they functionally represented as beasts of burden and by supplying their owners with clothing food and milk Ships of the desert was an appropriate name for them and the wealth of biblical patriarchs was estimated by the herds they possessed

**Camel Corps**, formation mounted on camels for service in desert regions The first Egyptian camel corps was raised in 1884 for the Gordon relief

expedition and afterwards disbanded A second camel corps raised in Egypt and Sudan became a permanent section of the Egyptian army and now attached to the Sudan defence force numbers 1100 A further Camel Corps is maintained by the Maharaja of Bikaner an Indian native State and served in China (1900) Somaliland (1903-4) and Egypt (1910-1) as an imperial service unit A composite British Australian and New Zealand Camel Corps brigade was formed for service in Palestine (191-18) and fought at Romani Gaza Beer Sheva and Jerusalem before being reorganised as cavalry

**Camellia**, greenhouse evergreen shrubs with large flowers once very popular for use as buttonholes and still grown as indoor plants Many varieties can be propagated by cuttings but the best are usually grafted on established plants of the original *Camellia japonica* which is of very free growth

**Camelot**, in medieval romance the seat of King Arthur's court It has been variously located at Camelford (Cornwall) Caerleon upon Usk Winchester and elsewhere

**Camembert**, see CHEESE

**Cameo** a shell or precious stone with a design carved in relief The true cameo has coloured layers which allow a light design to be set off by a dark background or occasionally the reverse Cameo cutting originated in the East being later adopted by the Greeks and reaching an advanced state of excellence under Alexander the Great The cameos of the Renaissance (the art was neglected during the Middle Ages) are notable for fine workmanship but the stones used were as a rule inferior to those of the ancient cameos Shells as substitutes for stones were introduced into Rome from Sicily in the early 19th cent The cameo process is the reverse of the intaglio (*q v*) where the design is sunk instead of raised

**Camera** The word camera itself is an abbreviation of the ex



pression *camera obscura*, what we call a camera being in fact a dark chamber into which an image of some external object is projected by means of a lens (*qv*). Actually a photograph can be taken in a camera into which the light enters through a pinhole instead of a lens, but such a camera is very limited in its possibilities. Essentially, every camera consists of the "dark chamber" mentioned above, which we may call the "body" of the camera, a lens (*qv*), a cap or shutter for allowing the lens to be closed or opened for the passage of light, and a device for containing the sensitive material which will record the image received. Cameras are generally classified as "hand" or "stand" cameras, the latter being now mainly confined to studios and professional purposes, although every user of a hand camera will find that, at one time or another, he needs a stand or tripod to hold his camera steady. Another classification is that of plate-using cameras as opposed to those using roll-film, though it is often possible to employ a roll-film adapter in a camera normally taking plates, and *vice versa*. Still another classification is based upon the employment of a ground-glass screen for focusing.

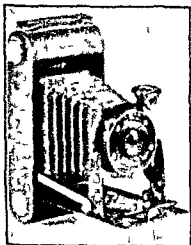
It will, perhaps, be convenient first to describe the construction of the stand camera in a simple form. It consists of two solid parts, the front and the back, hinged to a base and joined by bellows which enable the distance between the two to be modified at will. The front carries the lens, and can be moved backwards and forwards, and fixed to the base at any desired point. The back is fitted with a piece of finely ground glass, upon which the image can be focused. When the focus is correct, this ground glass is removed and a dark slide containing the plate inserted in its place. In order to prevent light reaching the plate except at the moment of exposure, a shutter is used. This will be described later. Should relatively long exposures only be

needed, a cap may take the place of the shutter.

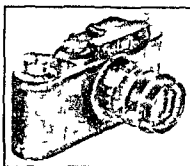
After this summary sketch of the construction of a camera, we may proceed to a short explanation of the various types in common use. Simplest of all is the box camera, familiar to everyone as a cheap, relatively fool-proof, but limited, instrument. This makes use of roll-film, the back of it opening and providing for the insertion of a full spool of film and an empty spool on to which the film is wound after each exposure. There is a small red window in the back of the camera, and the user knows when he has turned forward sufficient film by the appearance of a number in this window. The question of focusing is solved by using a lens of such a type that all objects beyond a certain distance from the camera are in focus on the film. The lens itself is usually of the achromatic type. As there is no focusing screen, a *finder* is provided which gives the user a reproduction, on a very small scale, of the picture he wishes to secure.

Folding hand cameras are also very commonly used, again principally with roll-film. In these, specially devised so that they take up very little space and easily slip into the coat pocket, the base of the camera folds back into the body, and is pulled out and held in position by struts when needed for use. In such cameras, focusing is usually by scale. The front is fitted with a pointer and the base with a scale marked in feet, and the front moved to the correct point of the scale corresponding to the distance of the object to be photographed from the camera. Here again, a *finder* is commonly mounted on the front of the camera. The shutter on a camera of this type usually operates between the components of the lens, and can be operated at various speeds up to  $\frac{1}{1000}$  second.

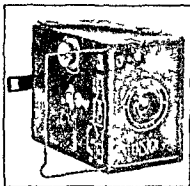
There is an almost endless variety of hand cameras, and no useful purpose would be served by attempting to give an account of them in detail. They vary very greatly in price, and some of them are of extremely elaborate con-



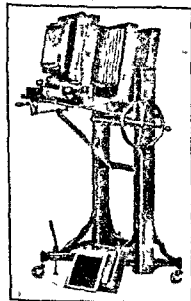
Folding Camera



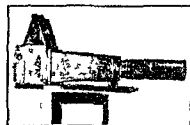
Leica M3 rangefinder camera with peculiar protrusion



Black and white camera



Studio Camera



Reflex Camera with peculiar long focus for photographing wild animals in nature

struction One of the most recent is fitted with a built-in range-finder, enabling the user to calculate the distance of the object he wishes to photograph to within a few inches This instrument is geared to the camera-front, and so arranged that it may be used when the apparatus is still closed At the pressure of a spring, the camera opens to the required extension The same camera has an exposure meter embodied in its construction

Press photographers favour a collapsible type of camera fitted with a focal-plane shutter and an anastigmat lens of wide aperture and permitting very short exposures Such a camera takes up a comparatively small space, the front fitting back flush with the back itself, and being easily pulled out to a position where it is held rigidly by lazy-tong struts Plates are most commonly used The finder usually consists of a metal frame fitted to the front of the camera, with a metal upright which has an eyehole bored through it fitted to the back The frame is made the size of the plate, and the distance of the eyehole from it is equal to the focal length of the lens It follows that by holding the eyehole close to the eye and centring it to correspond with the centre of the frame, it is possible to find approximately the picture that will appear on the plate Since the bellows are rigidly held by the camera struts, focusing is done by moving the lens itself in its cell The lens has a mount with a coarse screw thread which fits into a jacket similarly threaded The focal-plane shutter takes its name from the fact that, instead of working between the components of the lens, it works near the plane upon which the image cast by the lens is at its sharpest This is the place occupied by the plate, and the shutter consists of an arrangement whereby a slit of variable size passes rapidly across the plate from the top to the bottom, the actual exposure varying according to the width of the slit Such shutters are more consistently accurate in their timing,

and some are capable of giving exposures as short as  $\frac{1}{1000}$  second

Another popular, but relatively expensive, type of hand camera is the reflex, a type in which this country may fairly be said to take the lead It has many advantages over other kinds In the first place, focusing becomes the simplest possible matter The photographer can see exactly what his picture will be like in its full size, artistic composition being greatly facilitated He can focus most precisely without interfering with the plate waiting ready for exposure He can watch the perpendiculars and make sure that they are not "leaning" And work with a telephoto lens is very greatly simplified A serious disadvantage to many people, is the cumbersome weight of a reflex This is the case even with the folding type, especially to one who has been accustomed to the lightness and perfect portability of the pocket folding camera The reflex is usually box-shaped, with a mirror set at the appropriate angle inside the box When focusing, the lens casts an image upon this mirror which reflects it upwards upon a ground-glass screen When the user is satisfied with the picture he is getting, he presses a release which, at one and the same time, throws the mirror up against the ground-glass screen and releases the focal-plane shutter, thus making the exposure Such a type of camera is particularly useful for animal studies, especially in conjunction with a telephoto lens, and for portraiture, especially child portraiture

Stereoscopic photography is more popular on the Continent than in this country Cameras used for stereoscopic work are built on the same principle as any other, but the panel carrying the lens is fitted with two matched lenses, and the interior of the camera is divided into two parts, so that there is no overlapping of the two images Such divisions are usually made removable, and when the double lens panel is exchanged for one

with a single lens the camera can be used for ordinary photography

Enough has been said of the principal types of camera to make it clear that the amateur has a considerable choice. With all of them he will be able to do excellent work and his choice need only be limited by the amount he is prepared to pay for precision and workmanship. As regards the format he selects it should be remembered that with the recent development of such precise instruments as the best of the miniature cameras and the excellent grain and speed of modern plates and films it is now possible to secure perfect results with much smaller cameras than would have been considered practical a few years ago. See also PHOTOGRAPHY LENS etc

**Camera Obscura**, a light tight box invented 1679 having a convex lens at one end and a screen at the other. The rays of light coming from an object pass through the lens and form an image on the screen. The human eye is a form of camera obscura.

**Camerino** a Central Italian town situated on the E slopes of the Roman Apennine Mountains some 40 m SW of Ancona. Its chief industry is the manufacture of silk. It has a university founded in 1777 which specialises in veterinary medicine and is attended by over 900 students and a cathedral. Pop. 12,300.

**Cameron Sir David Young** (b 1855) Scots painter and engraver made an RSA in 1918 and RA in 1920. His engravings and paintings of Scots landscapes are widely admired and specimens of his work can be seen in galleries of modern art both in Britain and abroad. Knighted 1941.

**Cameron Verney Lovett** (1844-1894) explorer was born in Dorset and in his early years served with the Navy in the W Indies Mediterranean and Red Sea. In 1874 he commanded the Livingstone relief expedition and though too late to find that explorer alive retrieved his records and proceeded to explore Tanganyika. He later explored the Congo and found

the sources of the Zambezi. He was the first traveller to cross Africa from E to W accomplishing the feat in 1875. He was the author of *Across Africa* (1877) and *Our Future Highway to India* (1890) the latter based on explorations he made for a Constantinople-Bagdad railway.

**Cameronians** a body of Scottish Covenanters in the reign of Charles II so called after their leader Richard Cameron. They claimed to be true adherents to the principles of the original covenant (qv). In 1746 they formed a new body known as the Reformed Presbytery.

**Cameroons** or *Kamerun* a large coastal district of W Africa E of the Gulf of Guinea bounded on the N by Nigeria and Lake Chad and S and E by French Equatorial Africa. It was a German protectorate until the Treaty of Versailles but is now administered by Britain and France. The principal rivers are the Sanaga the Nyong the Mungo and the Wuri. The chief mountain which is actively volcanic is the Great Cameroon (13,000 ft). The district is a tropical one and very wet: the forests contain teak mahogany and ebony but the main products of the country are cocoa rubber palm kernels ivory kola nuts and copra.

The French Cameroon covers some 170,000 sq m while the British protectorate which is governed from Nigeria is only about 34,000 sq m in extent and stretches from the Great Cameroon along the Nigerian border to Lake Chad.

The population consists of Bantu negroes near the coast and Sudanese negroes inland. The figures are French Cameroons 2,750,000 British 690,000. The European population is about 5,500.

**Camisards** French Huguenot peasants of the Cévennes who resisted by force the attempt to carry out the Revocation of the Edict of Nantes (qv). From 1703 to 1705 the movement developed into a civil war which was ruthlessly suppressed.

**Cammaerts, Emile** (b 1878) Belgian

poet and professor of Belgian studies and institutions in the University of London, was born at Brussels, but settled in England in 1908, becoming widely known in the early years of the War for a series of *Belgian Poems* (1915 and 1917). He has also written critical and historical works

**Cammoens, Luis Vaz de** (c 1524-1580), Portuguese poet, author of the *Lusiads*, an epic of considerable length dealing with the voyages of Vasco da Gama. After early success at the Court in Lisbon Cammoens was exiled, probably through a love affair with Catharina de Ataíde, lady-in-waiting to the Queen. He spent 2 years in military service in Morocco and 17 years in the East, interrupted by periods of imprisonment for debt, and by shipwreck.

His return to Portugal in 1570 was followed by publication of the *Lusiads*, which secured him poetic fame and a short respite from poverty. He died of plague in Lisbon in 1580. Cammoens also wrote many exquisite lyrics, nearly all unpublished until after his death.

**Camomile**, flower-heads of *Anthemis nobilis* (family Composite). The name (Greek, "ground-apple") is due to the pleasant aromatic smell of the whole plant which resembles that of fresh apples. The scent, and the solitary composite heads of flowers, which droop before expansion, distinguish camomile from the several plants resembling it. The whole plant is very bitter and is valuable in medicine for its tonic properties. An infusion of the flowers makes the cottage remedy of camomile tea, and is also much used for shampoos. See also ANTHEMIS

**Camorra**, a Neapolitan secret society, appeared first in 1820. Composed of ex-prisoners, who engaged in blackmail, murder, and "racketeering" generally. After 1848 it dominated the Government of Naples, though its power was curtailed (1877). A State enquiry was held (1900) and the Camorra was ousted by the Honest Government League. Finally suppressed by Mussolini's Fascist Government.

**Camouflage** [KAN'ŌŌFLANZH], the disguise of men or machines in war to conceal their movements and identity from the enemy. Various simple methods of grass or bush covering have been practised since earliest times, but the introduction of neutral uniforms (British khaki in 1890, followed by French horizon-blue and German field-grey) marked the beginning of modern camouflage. In the World War tanks, guns, and buildings were painted to tone with their surroundings and so become less visible from the air. Ships were covered with grey-green geometrical designs.

**Camp**, a temporary open-air living place usually consisting of tents and chiefly organised by soldiers. A camp is a form of military accommodation intermediate between billets and bivouacs. It enables the troops to be kept more concentrated than in the former, and less exposed than in the latter. Permanent camps are organised for training. See CAMPING

**Campagna**, in Roman times, the plain extending all round Rome, much of it was malarial, and, although the soil was good, agriculture, once very flourishing, decayed. The numerous ruins show its one-time importance. The whole region is volcanic. Efforts at drainage and the elimination of malaria are being made.

**Campanella, Tommaso** (1568-1639), scholar, philosopher, and poet of the Italian Renaissance. He was imprisoned for 30 years, on suspicion of having attempted to liberate Naples from the domination of Spain. After his release he went to Paris, where he spent the last 5 years of his life, and found favour with Cardinal Richelieu. Some of his sonnets have been translated into English, as has his famous Utopia, *Civitas Solis* (*The City of the Sun*, 1623).

**Campania**, name borne by an ancient as well as a modern Italian province. The area of modern Campania is much the greater, and includes Benevento, Naples, Avellino, and Salerno. It lies S of Rome along the coast, its

S.E. boundary is Basilicata. The region is very fertile and is watered mainly by the R. Volturno. It produces maize, Falernian wine, wheat, fruit and sulphur. The area is 5500 sq. m. pop. 3,500,000.

**Campanile**, a bell tower originating in Italy belonging to a church or town hall but not actually incorporated in the building. Two famous examples are the Campanile of St. Mark's Venice and Giotto's Campanile in Florence. The earliest record of the construction of a campanile is in the 6th cent. A.D. The name is frequently but incorrectly applied to the tower of Westminster Cathedral.

**Campanology** see **BELL**.

**Campanula**, hardy perennial ideal for window boxes, rockeries and hanging baskets or in the case of the taller and erect species for the border. The flowers are large and bell-shaped on graceful slender stalks. White and all varieties of blue. Ideal for cutting.

**Campbell, Beatrice Stella** (Mrs. Patrick Campbell) née Tanner (b. 1861) distinguished British actress. Her first London appearance was in 1890 in *The Hunchback*. She scored an outstanding success in *The Second Mrs. Tanqueray* 3 years later. Among her many successes have been *Magda*, *Pygmalion*, *The 13th Chair*, many Shakespearean, Shaw and Ibsen rôles. In 1913 she acted in Sophocles' *Electra*. She has acted with Sarah Bernhardt and achieved great success in America.

**Campbell, Sir Malcolm** (b. 1855)



Sir Malcolm Campbell

British racing motorist. 8 times holder of the world speed record. He set up his latest figures (272.46 miles per hour) at Daytona in 1933. He began his racing career motor cycling in Germany and elsewhere. Knighted 1931.

**Campbell, Reginald John** (b. 1867) an English divine born in London of a Scottish Nonconformist family, became a Congregational Minister in 1895 and was ordained priest in the Church of England in 1916. He has been Residentiary Canon and Chancellor of Chichester since 1930 and has written numerous popular religious works including *The New Theology* which caused some sensation on its publication in 1907.

**Campbell, Roy Dunnachie** (b. 1901) S. African poet born at Durban after engaging in a number of professions finally settled in France as part owner of a fishing fleet. *The Flaming Terrapin* (1924) and *The Waygoose* (1928) show tremendous vitality and a not inconsiderable satirical gift.

**Campbell, Thomas** (1777-1844) Scottish poet well known for his patriotic poems such as *Ye Mariners of England*, *The Bile of the Baltic* and *Hohenlinden*. He is buried in Westminster Abbey.

**Campbell Bannerman, Sir Henry** (1836-1908) British politician. He became Prime Minister in 1905 and resigned just before his death. He first entered Parliament in 1869. He succeeded Sir W. Harcourt as leader of the Liberal Party in 1898 and formed his first Cabinet after the Tory downfall in 1905.

After the 1906 election which gave the Liberal Party an overwhelming majority, his Government included H. H. Asquith, Sir Edward Grey, John Morley, Mr. Lloyd George and Mr. John Burns. Ill health, however, soon limited Campbell Bannerman's activities in Parliament and brought about his resignation in April 1908. His leadership of the Liberals produced no outstanding achievements but he kept the party together at a difficult time.

**Campbellites**, followers of Alexander

continued to preach up and down the country, evading arrest, and distributing an illegally printed attack on the Anglican Church. He was captured and thrown into the Tower in 1581, and executed on Dec 1 after six months of confinement and intermittent torture. Leo XIII beatified him in 1886.

**Campion, Thomas** (1567-1620), English Elizabethan poet and a London physician. He composed a number of masques and books of songs the music for which he also wrote. The first edition of his collected works appeared in 1880.

**Camrose** (*William Ewert Berry*), 1st Baron (b 1879), newspaper owner and journalist. In 1907 he founded the *Advertising World*, and in 1915 became Editor-in-Chief of the *Sunday Times*. With his brother, Sir Gomer Berry (qv), he is part owner of the *Daily Telegraph*, has a controlling interest in Allied Newspapers, Ltd., and Amalgamated Press, Ltd., and is Chairman of the *Financial Times*.

**Cannan**, originally the name of the low-lying coastal districts of Palestine, later extended to all that part of Palestine lying W of the Jordan, the "Promised Land" of the Biblical story. Cattle-breeding and wine producing are still carried on.

**Canaanites**, name given in the Old Testament by the Jews to the people of several different tribes inhabiting the Jordan valley and the land between it and the coast. The name apparently includes all the pre-Israelite inhabitants of whom the early Jews had cognisance. The term also means "a merchant," and was presumably also applied to the Phœnicians.

**Canada**, a British Dominion occupying most of the N half of the N American continent, and extending in the extreme N upwards of 1200 m into the Arctic Circle. It is bounded on the W by Alaska and the Pacific, on the E by Baffin Bay, Davis Strait, and the Atlantic, and in the S by a line E along lat 49° N to the Great Lakes, and then irregular, terminating just above lat 45° N

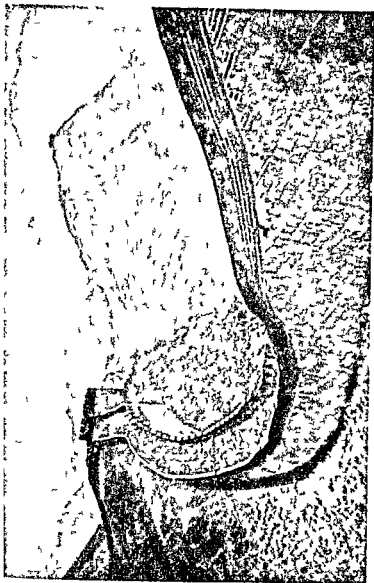
Hudson Bay and its continuation, James Bay, penetrate far into the interior from the N. The coasts are deeply indented, and provide numerous natural harbours, many of which become ice-bound in the winter. There are a number of islands on the Pacific coast, the most important being Vancouver Island and Queen Charlotte Island, on the N. coast is a great ice-bound archipelago almost uninhabitable, and on the E. are Newfoundland (not a part of the Dominion), Anticosti Island, Prince Edward Island, and Cape Breton Island.

The highest mountain ranges are in the W, and are made up of a long stretch of the Rockies, together with the Selkirks, the highest peaks are Mount Logan (10,850 ft) and Mount St Elias (18,000 ft). Nearer the coast are the Cascade and Coast ranges. Towards the E. coast, and beyond the Great Lakes, and respectively N.W. and S.E. of the St Lawrence, are the Laurentians and the Appalachians, which do not rise much above 3000 to 4000 ft.

Canada is plentifully provided with lakes and rivers, which are of primary importance for power and transport. Joined up by canals, a great waterway begins in Lake Superior, and thence proceeds through Lakes Huron, Michigan, Erie, and Ontario to the St Lawrence R., and so into the Gulf of St Lawrence. Another system of less importance begins in the Lake of the Woods, and proceeds *via* Lake Winnipeg and Nelson R to Hudson Bay, a third proceeds from Reindeer Lake through Lakes Athabasca and Great Slave to the Mackenzie R., which flows into Beaufort Sea (see GREAT LAKES).

This system includes the Athabasca R flowing into the lake of that name, Peace R., and Slave R. In the N.W. is the Yukon, flowing through that territory and Alaska to the N.W. coast, and in the W are the Columbia and Fraser Rs.

Three great geological periods followed by glaciation have determined



THE GREAT WALL OF CHINA

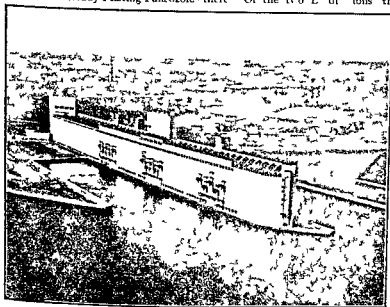


**Campeachy**

Campbell (1788-1868)  
pastor in the U S

the topography of Canada. The oldest mountain formation which occupied the area around Hudson Bay had been worn almost flat at the end of the Archæan age and sand and clay were deposited on it in the Palæozoic period forming a new surface which ridged up in the E into the present mountain ranges. To the W and S W of this region Mesozoic sediment was laid down on the already existing Palæozoic

divisions in the E and two in the W the N forms one great area larger than the others put together. This is in the main a region of great rivers and includes the Nelson and the Mackenzie it is fairly high above sea level and parts of it are similar to the tundra region in Russia the rocks forming its surface are very old and much of the mineral wealth of Canada is found there. Of the two E divisions the

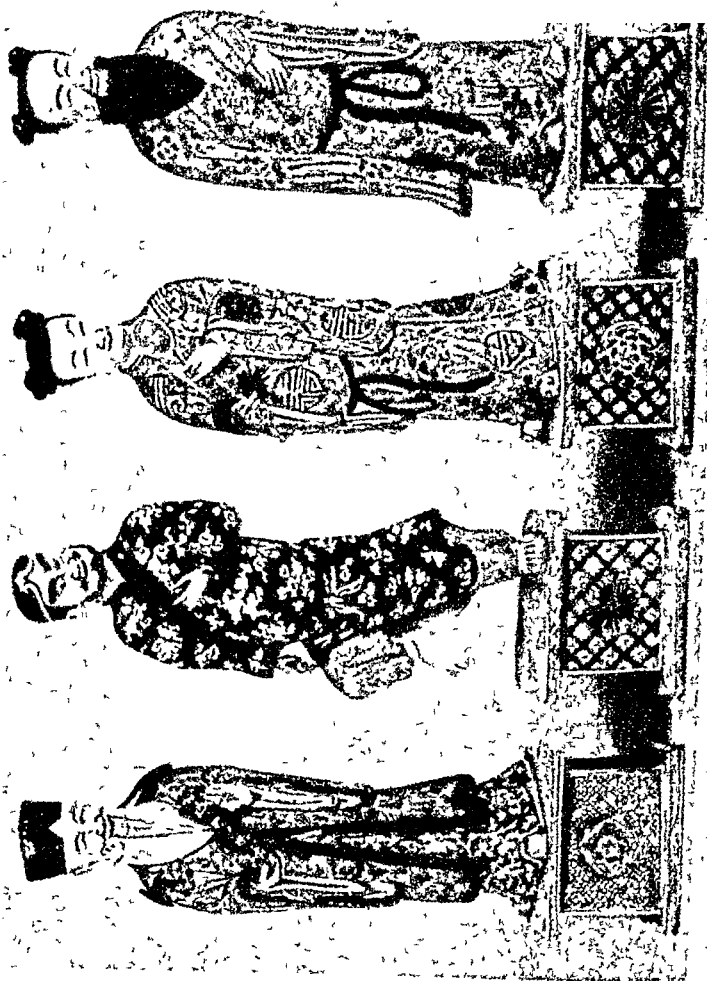


Toronto Great Lakes

rocks so accounting for the Prairies. On the W the rocks were thrust up and conformed with the Pacific ranges to the S giving the Canadian Rockies and the Coast Range. Finally the glacial period partly denuded the surface and at its passing left Canada much as it is in modern times. The country divides itself naturally into regions as different in their physical features as in their products. Taking the Red R. valley as the dividing line between E. and W there are two

first lies S and E of the St. Lawrence to a line level with Montreal and is hilly with some good pasture and agricultural country. It was this area that was known to early settlers as Arcadia. Farther S and W is a large and fertile country with occasional rocky outcrops and merging into the Great Lakes.

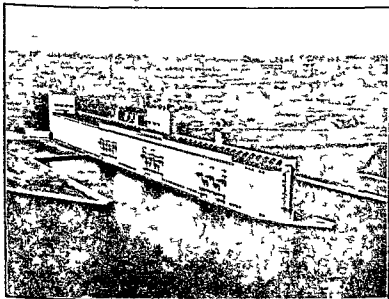
There are a number of valuable mineral deposits both in the Rocky Mountain system and in the N W. Gold copper lead and silver may be



CHINESE PORCELAIN FIGURES  
(K'ang Hsi Period)

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Toronto to Lake Huron.

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mentioned, with coal, petroleum, and natural gas

The climate is extremely variable, but throughout most of the country it is healthy and bracing, there is heavy rain on the mountains, and snow falls on a widespread area in winter. There are no plants of outstanding interest, but the country is very rich in timber. Native fauna include the musk-ox, caribou, moose, bear, fur-bearing animals: marten, beaver, silver fox, etc.

Canada is a country of great agricultural importance, the annual production of both wheat and barley is in the neighbourhood of 300,000,000 bushels, and butter, cheese, and milk are produced in enormous quantities, about a quarter of the whole Dominion is given over to agriculture and fruit, cattle and sheep, and tobacco are produced. Industry, which has been growing rapidly during this century, is centred mainly in Quebec and Ontario, and is a source of great profit, timber, paper, fur-farming, meat-packing, saw-mills, and automobile construction are among the most important trades, and there is a very large and valuable fishing industry.

Canada has first-class transport facilities, partly by reason of the excellent natural waterways which are linked by canals where possible, and partly through a widespread and efficient railway system. Roads are good, as are postal, telephone, and telegraph services. The population is predominantly British, with many French, a few Germans and Jews, and about 100,000 Indians, it numbers about 10½ millions, and is growing steadily. There is no State religion, but there is a heavy majority of Roman Catholics, while Anglicans and Non-conformists are well represented. Education is very liberal, and every encouragement is given to the poorer classes, there are a number of Universities, including those of McGill, King's College, and Alberta. Scientific and technical education receive considerable attention.

There are 11 political divisions in the

Dominion as follows: the 9 provinces of Nova Scotia, New Brunswick, Prince Edward Island, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, British Columbia, the N.W. Territory, and the territory of Yukon. The provinces are each administered by a Lieutenant-Governor, assisted by an Executive Council and a Legislative Assembly. The Central Government consists of the Governor-General, advised by the King's Privy Council for Canada, the Senate, with 96 life members, appointed by the Governor-General, and a House of Commons, of 245 members, elected on a wide suffrage every 5 years.

*History.* It is believed that Leif Ericsson, a Norse explorer, was the first to discover Canada about A.D. 1000, his settlement was dispersed by the Indians, and no further attempts were made until John Cabot reached Canada in 1497. For some years afterwards fishermen used the Newfoundland banks, but it was not until 1535 that another decisive step was taken, when Jacques Cartier sailed up the St. Lawrence. French colonisation began seriously with Samuel de Champlain in the early 17th cent. This was disturbed by English raids during the Thirty Years' War, but at the treaty of St. Germain-en-Laye (1632) France was again left in undisputed possession of the country. Slow exploration, and keen efforts at settlement by Catholic missionaries followed, but not much was accomplished until Frontenac became the Governor and succeeded in placating the tribes. War with England intervened again, and at the Treaty of Utrecht (1713) England gained Newfoundland, Hudson Bay, and Nova Scotia. The French, who still held the St. Lawrence, and had penetrated to the Mississippi, now determined to make good their grasp on the interior, but failed to receive adequate support from the Government. Bickering took place between English and French settlers, and the situation became steadily more difficult until the Seven Years' War in

1758 In 1759 Wolfe was victorious at Quebec and in 1763 by the Peace of Paris Britain finally gained the whole country.

The Constitutional Act (1791) is the next important point in Canadian history for by it the country was divided into Upper and Lower Canada the French who occupied Lower Canada mainly being allowed many of their old laws and privileges. This system did not work however and after two revolutionary attempts the Act of Union (1840) joined the two provinces once more. Matters did not attain a satisfactory footing national jealousy being too acute but the problem was settled in the most fortunate way by the projected union of New Brunswick Nova Scotia and Prince Edward Island with Upper and Lower Canada. A Conference was held and in 1867 the British North America Act united the five provinces and the Dominion of Canada came into being. Within the next few years the rest of the Canadian states were admitted to the Union and now only Newfoundland is outside it.

It was the necessity for transport in the newly unified country that raised the project of a great railway and the Canadian Pacific Railway was begun in 1881 it was opened to Vancouver in 1885 and completed in 1891. Thereafter until the outbreak of war in 1914 Canada was concerned with domestic problems and was steadily growing in prosperity. In that year she at once mobilised troops which were of the utmost value to the Allies though the question of conscription became a difficult one. Since the War party politics have been aggravated by economic depression. In the last few years however Canada has begun to regain ground. At the Imperial Conference of 1908 Canadian status was raised to that of a free and independent partner of the British Commonwealth of Nations. She is a member of the Imperial Conference and of the League of Nations (see BRITISH EMPIRE).

**Canada Balsam**, a resinous substance extracted from the wood of fir trees used in varnishes and for mounting microscopic preparations.

**Canadian Literature** (1) *English*. The chief poets are Bliss Carman Archibald Lampman W. W. Campbell and Robert Service. The earliest novelist was John Richardson (1796-1866) and among notable later novels and fiction are William Kirby's *The Golden Doe* (1897) Sara Duncan's *A Social Departure* (1899) the short stories of Marjorie Pickthall and Thompson Seton's animal stories. The literature is also very rich in historians (2) *French*. Since 1860 there has been a fairly continuous output of poetry patriotic descriptive and meditative. There have not been many notable novels but there is a considerable body of essays and sketches and of critical and philosophical writings. François Xavier Garneau's *Histoire du Canada* (1845-48) is still a standard work and another important history is the *Cours d'Histoire du Canada* of Thomas Chapais.

CONSULT *Oxford Book of Canadian Verse* A MacMurchy's *Handbook of Canadian Literature* (1906) and vol. xiv of the *Cambridge History of English Literature* A Lorne Pierce's *An Outline of Canadian Literature* (1927).

**Canale, Antonio** (1697-1768) more commonly known as Canaletto Italian painter and engraver born at Venice his work is mostly architectural views of his native city. During his later life he also painted in England. His paintings are remarkable for their luminosity and spaciousness and their admirable handling of perspective. Examples are contained in most of the principal galleries of Europe including the National Gallery.

His pupil and nephew Bernard Bellotto closely imitated his master's work and is also sometimes referred to as Canaletto or Canaletto the Younger. **Canaletto**, see CANALE ANTONIO. **Canal Rays**, see ATOM.

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The climate is extremely variable, but throughout most of the country it is healthy and bracing, there is heavy rain on the mountains, and snow falls on a widespread area in winter. There are no plants of outstanding interest, but the country is very rich in timber. Native fauna include the musk-ox, caribou, moose, bear, fur-bearing animals, marten, beaver, silver fox, etc.

Canada is a country of great agricultural importance, the annual production of both wheat and barley is in the neighbourhood of 300,000,000 bushels, and butter, cheese, and milk are produced in enormous quantities, about a quarter of the whole Dominion is given over to agriculture and fruit, cattle and sheep, and tobacco are produced. Industry, which has been growing rapidly during this century, is centred mainly in Quebec and Ontario, and is a source of great profit, timber, paper, fur-farming, meat-packing, saw-mills, and automobile construction are among the most important trades, and there is a very large and valuable fishing industry.

Canada has first-class transport facilities, partly by reason of the excellent natural waterways which are linked by canals where possible, and partly through a widespread and efficient railway system. Roads are good, as are postal, telephone, and telegraph services. The population is predominantly British, with many French, a few Germans and Jews, and about 100,000 Indians, it numbers about 10½ millions, and is growing steadily. There is no State religion, but there is a heavy majority of Roman Catholics, while Anglicans and Non-conformists are well represented. Education is very liberal, and every encouragement is given to the poorer classes; there are a number of Universities, including those of McGill, King's College and Alberta. Scientific and technical education receive considerable attention.

There are 11 political divisions in the

Dominion as follows: the 9 provinces of Nova Scotia, New Brunswick, Prince Edward Island, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, British Columbia, the N.W. Territory, and the territory of Yukon. The provinces are each administered by a Lieutenant-Governor, assisted by an Executive Council and a Legislative Assembly. The Central Government consists of the Governor-General, advised by the King's Privy Council for Canada, the Senate, with 96 life members, appointed by the Governor-General, and a House of Commons, of 245 members, elected on a wide suffrage every 5 years.

**History.** It is believed that Leif Ericsson, a Norse explorer, was the first to discover Canada about A.D. 1000; his settlement was dispersed by the Indians, and no further attempts were made until John Cabot reached Canada in 1497. For some years afterwards fishermen used the Newfoundland banks, but it was not until 1635 that another decisive step was taken, when Jacques Cartier sailed up the St. Lawrence. French colonisation began seriously with Samuel de Champlain in the early 17th cent. This was disturbed by English raids during the Thirty Years' War, but at the treaty of St. Germain-en-Laye (1632) France was again left in undisputed possession of the country. Slow exploration, and keen efforts at settlement by Catholic missionaries followed, but not much was accomplished until Frontenac became the Governor and succeeded in placating the tribes. War with England intervened again, and at the Treaty of Utrecht (1713) England gained Newfoundland, Hudson Bay, and Nova Scotia. The French, who still held the St. Lawrence, and had penetrated to the Mississippi, now determined to make good their grasp on the interior, but failed to receive adequate support from the Government. Bickering took place between English and French settlers, and the situation became steadily more difficult until the Seven Years' War in

1756 In 1759 Wolfe was victorious at Quebec, and in 1763 by the Peace of Paris Britain finally gained the whole country.

The Constitutional Act (1791) is the next important point in Canadian history for by it the country was divided into Upper and Lower Canada the French who occupied Lower Canada mainly being allowed many of their old laws and privileges. This system did not work however and after two revolutionary attempts the Act of Union (1840) joined the two provinces once more. Matters did not attain a satisfactory footing national jealousy being too acute but the problem was settled in the most fortunate way by the projected union of New Brunswick Nova Scotia and Prince Edward Island with Upper and Lower Canada. A Conference was held and in 1867 the British North America Act united the five provinces and the Dominion of Canada came into being. Within the next few years the rest of the Canadian states were admitted to the Union and now only Newfoundland is outside it.

It was the necessity for transport in the newly united country that raised the project of a great railway and the Canadian Pacific Railway was begun in 1891 it was opened to Vancouver in 1885 and completed in 1891. Thereafter until the outbreak of war in 1914, Canada was concerned with domestic problems and was steadily growing in prosperity. In that year she at once mobilised troops which were of the utmost value to the Allies though the question of conscription became a difficult one. Since the War party politics have been aggravated by economic depression. In the last few years however Canada has begun to regain ground. At the Imperial Conference of 1926 Canadian status was raised to that of a free and independent partner of the British Commonwealth of Nations. She is a member of the Imperial Conference and of the League of Nations (see BRITISH EMPIRE).

**Canada Balsam**, a resinous substance extracted from the wood of fir trees used in varnishes and for mounting microscopic preparations.

**Canadian Literature** (1) *English* The chief poets are Bliss Carman Archibald Lampman W. W. Campbell and Robert Service. The earliest novelist was John Richardson (1796-1857) and among notable later novels and fiction are William Kirby's *The Golden Dog* (1897) Sara Duncan's *A Social Departure* (1890) the short stories of Marjorie Pitchall and Thompson Seton's animal stories. The literature is also very rich in historians (2) *French* Since 1860 there has been a fairly continuous output of poetry patriotic descriptive and meditative. There have not been many notable novels but there is a considerable body of essays and sketches and of critical and philosophical writings. François Xavier Garneau's *Histoire du Canada* (1845-48) is still a standard work and another important history is the *Cours d'Histoire du Canada* of Thomas Chapais.

CONSULT *Oxford Book of Canadian Verse* A MacMurchy's *Handbook of Canadian Literature* (1906) and vol. xiv of the *Cambridge History of English Literature* A Lorne Pierce's *An Outline of Canadian Literature* (1907).

**Canale, Antonio** (1697-1768) more commonly known as Canaletto Italian painter and engraver born at Venice his work is mostly architectural views of his native city. During his later life he also painted in England. His paintings are remarkable for their luminosity and spaciousness and their admirable handling of perspective. Examples are contained in most of the principal galleries of Europe including the National Gallery.

His pupil and nephew Bernard Bellotto closely imitated his master's work, and is also sometimes referred to as Canaletto or Canaletto the Younger. **Canaletto**, see CANALE ANTONIO. **Canal Rays**, see ATOM.



**Canals**, open waterways, constructed for purposes of water supply or for navigation. In England the term is generally reserved to cover navigational waterways. Canals may be divided into three classes: (1) level canals, consisting of one reach throughout, a well-known example being the Suez Canal, (2) lateral canals, in which the fall is in one direction only, (3) canals with summits, in which the canal follows a varying line of levels. In the last two kinds the canals are arranged in a series of reaches, the reaches being at different levels, and some device, such as a lock or hydraulic lift, must be provided to transfer boats from one reach to another.

Canals, except under special circumstances, are always wide enough to admit the passage of two boats together. The breadth at the bottom should not be less than twice the greatest breadth of a boat, the least depth should be equal to the greatest draught of a boat with  $1\frac{1}{2}$  ft added. The bottom of the canal is generally flat, the sides if of earth are sloped at a gradient of  $1\frac{1}{2}$  to 1, and if of masonry are vertical. The cheapest form of canal is that in which the upper part of the waterway is confined between banks and the lower part is in excavation. In the construction of such a canal the earth from the excavation is merely shifted a few yards to form the banks. An embankment which carries a towing path is 12 ft wide at least, an ordinary embankment being 4-6 ft wide at the top. Embankments, if of earth, are provided with puddle clay cover, 2 ft to 3 ft thick, to prevent leakage. Sheet piling may be necessary in special cases. If excessive scour is experienced, as is often the case since the introduction of steam and petrol barges, it may be necessary to line the sides of the canal with stone pitching. The majority of the canals in England have been designed with a view to haulage by horses. The towing path is generally made to slope away slightly from the canal in order to give

the horse a better footing. The heaviest boat which one horse can draw, at  $2-2\frac{1}{2}$  m per hour, is one weighing about 105 tons. Such a barge would be about 70 ft long, 12 ft broad, and with a draught of  $4\frac{1}{2}$  ft.

The lock is the most usual device for transferring a boat from one level to another. A lock is a rectangular tank, the long sides and bottom being constructed of masonry or concrete, and the level of the bottom being the same as the level of the lower reach. The lock is closed by a pair of gates at each end. The gates are side hinged and open towards the higher level only. The combined width of a pair of gates is somewhat greater than the width of the lock, so that the gates, when shut, are pressed firmly together at their outside edges by the water pressure. Each pair of gates is provided with sluices to admit the passage of water. The following is the procedure when a boat is to pass from the lower reach to the upper reach. Both pairs of gates are shut and the sluices in the lower gate are opened. The lock is then emptied and when the water level is the same on both sides of the lower pair of gates the latter may be opened and the barge passes into the lock. The lower gates are then shut and the sluices in the upper gates are opened. The lock then fills with water and the barge is floated to the level of the upper reach, the upper gates are opened and the barge floats out. It is impossible to open a gate unless the water level is the same on both sides. Where the difference in level between two reaches is considerable, it is usual to distribute the lift between a number of locks. The maximum lift of a single lock is about 12 ft, the usual figure being 8 ft or 9 ft. In a flight of locks the bottom level of one lock is half-way between the top and bottom levels of the lock below. It is more economical, as regards water, to distribute the lift between single locks, with reaches in between, rather than to concentrate the whole lift at one flight.

From the foregoing description it will be seen that a considerable amount of water passes through the lock from the upper reach to the lower reach each time the lock is used. Means must therefore be provided for replenishing the water used. The most usual method is to construct reservoirs in such a position and at such a level that they can be fed into the canal at its highest points. The water will then distribute itself by gravity. Lakes or streams may be utilised for supply purposes. Weirs must be provided at intervals along the length of the canal to dispose of surplus water and to permit of the emptying of a section should repairs be necessary.

Locks are necessarily a very slow means of transferring boats from one level to another. To obviate this difficulty mechanical devices are sometimes introduced. These are of two forms: the incline and the hydraulic lift. In the incline the boat enters a tank at the lower level. The tank is wheeled and runs on rails and is connected by a cable passing over a pulley to a similar tank at the upper level. As the two tanks are identical it requires only a slight difference in weight to cause the heavier tank to move down the incline at the same time drawing the lighter tank to the upper end. The difference in weight is obtained by admitting extra water ballast to whichever tank is at the upper end.

In the hydraulic lift the boat enters a tank which is lifted vertically. The tank is balanced by another similar tank and the two are worked by hydraulic rams whose cylinders are connected. As before the tanks are caused to move relatively to each other by giving slight additional weight to whichever tank is at the top.

Navigation on many rivers has been improved by the process known as canalisation. This consists of the division of the river into reaches the construction of locks at the necessary points, and dredging, widening and strengthening the banks. A canalised

river is of course supplied naturally with water.

**Canal Transport.** Irrigation canals have been known since earliest history, but canals for transport of goods in the modern sense were first constructed in France at the beginning of the 17th cent. the earliest being the Languedoc Canal joining the Mediterranean with the Bay of Biscay.

In England the development of canals did not begin until the dawning Industrial Revolution brought the need for cheap inland transport. In 1790 the Duke of Bridgewater commissioned James Brindley to build a canal between Manchester and his collieries at Worsley which was opened two years later. It proved a great success and seventy years of rapid canal building followed. These canals however which were financed by private companies were usually short and unco-ordinated. At the present time there are nearly 4000 miles of canals in the United Kingdom with a minimum gauge of 7 ft (30-ton barges) and although 40 per cent. of the mileage remains a 14-ft standard (60-ton barges) this is broken up by short lengths of smaller gauge which prevent their economic use. The most important canal in Great Britain is the Manchester Ship Canal (q.v.).

The early barges which carried coal, iron-ore, building materials and other bulky raw materials and products of industrialism were drawn by horses on a tow path. Steam tugs were first introduced on the Forth and Clyde Canal in 1800 and are successful in towing barge trains on canals where there are few locks. Internal combustion engines are also used on individual barges.

The expansion of railways in the 19th and 20th centuries robbed the canal of much of their traffic except in the case of bulky goods where cheap transport is of more importance than speed. The canal companies in many cases sold their properties to the railways which in 1905 owned almost one-third of the canal mileage in the United Kingdom.

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**Canning George (1770-18 )** English Tory statesman. Prime Minister in 1827 until his death five months later entered the House of Commons in 1793 as a supporter of Pitt. Canning soon became known in the House as a brilliant speaker. In 1800 he married a wealthy heiress Miss Joan Scott.

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George Canning

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periodicals notably *The Anti-Jacobin*.

**Canning** the preservation of fruits and meats in sealed airtight containers. It is said that fruit was preserved by heating and sealing in vessels in ancient days. Meat cooked with sufficient fat to cover it when placed hot in a vessel remains fresh for a long time and this method must have been used from early times though the commonest mode of preservation of meat and fish has always been smoking and partial drying. The first suggestion of sealing meat in a can by soldering was made by Appert in 1810. No explanation of its efficacy was given until Pasteur in estimating fermentation demonstrated that all putrefactive changes in organic materials are due to the action of living organisms and showed that once these are killed the changes are prevented. All bacteria are destroyed by very short exposure to the boiling temperature of water and usually at a much lower temperature when in their active form but certain bacteria (spores) which require many hours at boiling point before they are killed. Destruction of these spores can be effected in one of two ways - by waiting for them to pass into the active or vegetative form and then killing the bacteria by exposing the spores themselves to a sufficiently high temperature to kill them quickly. For these reasons meat when canned is always over-cooked. Spores will not germinate in a slightly acidic fruit and tomatoes do not require to be exposed to high temperatures but most vegetables are not sufficiently acid to be treated in this way.

Many methods of canning are used in fact. The older method consists of introducing the food and soldering on the lid of the can but leaving a small opening to be afterwards closed by solder when the contents have been sterilized by heat.

Nowadays this is but a largely replaced especially for fruit and vegetables by the use of much more reliable

Trent and Diet of Worms vigorously attacked the reforming movement. He was largely concerned with the compilation of the *Catechism of the Council of Trent*, the summary of Catholic doctrine prepared to counteract the Protestant attacks. He was canonised and declared a Doctor of the Church in 1921.

**Canis Major**, see CONSTELLATIONS

**Canker Worm**, a general term for any insect larva that destroys fruit, blossoms, or other vegetation.

**Cannabis Sativa**, see HEMP

**Cannæ**, ancient village of Apulia, Italy, c 42 m NW of Bari, the site of Hannibal's victory over the Romans in 216 BC. There are valuable Roman remains in the district.

**Cannan, Edwin** (b 1861), Emeritus Professor of Economics in the University of London, Dean of the Faculty of Economics at that University. He was educated at Clifton and at Balliol, and appointed President of the Royal Economic Society in 1932. He is the author of a number of works dealing with Economics, including *Wealth* (1914), *Money Its Connexion with Rising and Falling Prices* (1918), *An Economist's Protest* (1927), and *Review of Economic Theory* (1929).

**Cannes**, winter health resort on the French Riviera, about 30 m from the Italian border. Its natural beauty and excellent climate attract visitors from all over Europe. The surrounding district is extremely fertile, and produces olives, peaches, grapes, lemons, oranges, and flowers. Perfumes are manufactured. Pop 42,400.

**Cannes, Conference of** (Jan 6-13, 1922) attended by the Supreme Council of the Allies to discuss reparations (*qv*). Lloyd George introduced other questions of political security and economic reconstruction. He stated that reparations, security, and reconstruction must be considered together and in conjunction with Russia. He suggested the possibility of a British guarantee to assist France in the case of an unprovoked German invasion. It was decided to summon

a conference to deal with these questions (see GENOA CONFERENCE). The conference broke up on the fall of the Briand ministry without having settled the reparations problem.

**Cannibalism** (*Anthropophagy*) is essentially the eating of human flesh by human beings. In its classic form it is not an appetite, but a cult. As an appetite it occurs among civilised people under the stress of abnormal conditions, for instance, a siege or shipwreck.

**Cannibalism of Savages**. This is practised for two reasons, either as a mark of respect for the dead person whose body, or part thereof, is consumed, or to acquire, by homeopathic magic, part of the *mana* (virtue or power) of the deceased.

The ritualistic form of cannibalism is very widespread, and is represented in indirect customs, such as the use of a dead man's skull for a drinking vessel, and the sacramental ingestion of the body and blood of a dead god represented in symbolic form. The Mexican cannibalistic feast, at which human flesh was served in vessels of gold and silver to a highly civilised people, was a religious rite of this order.

The savage who devours an enemy after slaying him does so, not only to acquire the *mana* of the dead man, but to protect himself from revenge. Identified with the dead, he is immune from attacks by the dead man's relations and incidentally by the ghost of the departed.

To the primitive mind such identification is very real, hence the custom of spitting into each other's mouths to seal a bargain. Each man having thus partaken of the other's *mana*, holds his life also, and treachery between them is impossible. This motif is traceable in the annual Totem feast (see TOREMISM).

**Canning, Charles John, Earl** (1812-1862), son of George Canning (*qv*). Governor-General of India (1855-62). Educated at Eton and at Christchurch, he became Tory M.P. for

Warwick in 1836 but on his mother's death in the following year succeeded to the viscounty granted to her upon his father's death. Sir Robert Peel appointed him Under Secretary for Foreign Affairs in 1841 and he held this position for 5 years. In 1853 he became Postmaster General and Governor General of India in 1855 which position he held throughout the Indian Mutiny (1857). He was not to blame for that calamity and indeed he handled the crisis with calm wisdom. His advocacy of reforms in political and financial administration and his willingness to compromise with the native princes helped to reconcile India. He was rewarded with a vote of thanks from both Houses of Parliament by acclamation and the Order of the Garter. He died childless in London almost immediately on his return to England.

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Many methods of canning are used in practice. The oldest method consists of introducing the food and sealing on the lid of the can but leaving a small opening to be afterwards closed by cork or when the contents have been sterilized by heat.

Nowadays this is being largely superseded by the use of a vacuum which



George Canning

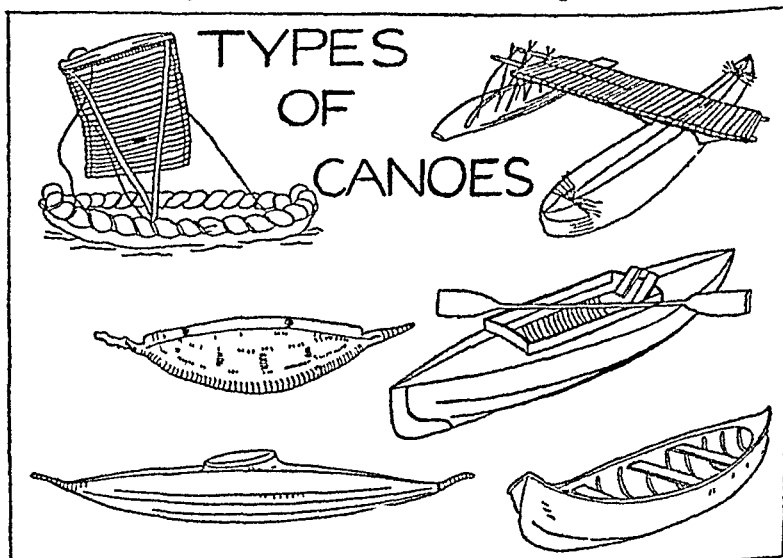
exhausts all air from the can while the metal cover is being fitted. Meat for canning is cut into suitable sizes and partially cooked, during which process it shrinks to about two-thirds the original volume. It is then placed in tins, sterilised by heating with steam in boilers under pressure. The cans are then sealed by solder and re-heated to a temperature of about 250° F for 1-2 hours. In some cases the air is expelled by a pump after the can is filled. It is then sealed and heated in a liquid bath to a temperature of 240° F. It is important that the plate for cans should have a coating of tin free from minute pinholes. Tin plate is a soft-iron sheet coated with tin by immersion in a bath of the molten metal. Tin is scarcely attacked by acid liquid, but iron is, and if the tin coating is imperfect, a leak may develop. A recent great advance was the discovery of lacquers which further protect the iron and tin from the action of acids in the food.

See also FOOD PRESERVING

**Cannon**, a heavy fire-arm mounted

on a carriage or fixed support. Although a form of cannon or mortar was developed soon after the invention of gunpowder in 1300, the word is first used a hundred years later. In the time of Henry VIII it began to be applied only to larger pieces, and is now used for those of greater calibre than 1½ in. (See ARTILLERY)

**Canoe**, a light boat, pointed at both ends, usually propelled by paddling. It developed from a hollowed-out log, often held upright in the water by an outrigger, and in this form is still used in Africa, S America, and the Pacific. N American Indians used canoes of birch bark. Some Pacific islanders build light shells of thin wood, cut into planks with stone adzes. Here, too, were big sail canoes holding 100 people and travelling hundreds of miles at sea. Modern canoes are of cedar and pine, sometimes of waterproofed canvas, when they may be collapsible and fold into a suitcase. Such canoes have crossed the English Channel



**Canon** (1) A law or rule (*see* CANON LAW) (2) Collection of sacred writings *e.g.* the Buddhist Canon and the Canon of the Old and New Testaments (*q.v.*) (3) Dignitary of the Church of England. There are three classes—Residentiary Canons, paid clergymen attached to a Cathedral; Honorary Canons, a title of esteem only; and Minor Canons, assistant clergy of a Cathedral. The dignity also exists in the Roman Catholic Church. (4) Members of some religious orders *e.g.* Augustinian Canons.

**Canoness**, female member of a religious order distinguished from a nun by being allowed to possess property. They were found among both Protestants and Catholics shortly after the Reformation. Communities of Canonesses still exist in the Roman Catholic Church *e.g.* the Canonesses of the Holy Sepulchre at New Hall in Essex.

**Canonisation**, the process by which a person of exceptionally holy life is proposed for the veneration of the faithful in the Roman Catholic Church. A series of judicial enquiries take place at which all aspects of the candidate's life are minutely examined and proof that miracles have been worked through his or her intercession is adduced. Beatification (*q.v.*) is a necessary preliminary.

**Canon Law** ecclesiastical law. Based on a variety of sources: tradition, episcopal and papal decrees, decrees of synods and Councils, provincial and general, besides the authority of Christ and His Apostles in the New Testament. It corresponds to the Common Law of a secular State and the older portions of it such as are found in the Decretals of Gratian (*c.* 1150) are not all of absolute authority. This law is concerned on the one hand with the ecclesiastical constitution and on the other with the discipline and general rules of the Church imposed on its members. England before the Reformation was subject to the same canon law as Western Europe and in so far as the Pre-Reformation canons

have not been revoked by later ecclesiastical legislation they are according to a judgment of Lord Brougham still binding. The canon law of the Roman Catholic Church was finally codified in 1917 in the *Codex Iuris Canonici*.

**Canopic Vases**, earthenware vases used in Egyptian burial rites. The name is said to be derived from Canopus, an ancient town near the present Alexandria.

**Canopus**, *see* CONSTELLATIONS.

**Canopy** derived from the Greek *walditra* a masonry or netted notes in architecture, an ornamental projection over a door, window or altar. It is also applied to similar projections made of silk or tapestry. High dignitaries of the Church usually have a canopy on four poles borne over them when taking part in processions.

**Canova** Antonio (1757-1832) Italian sculptor born at Passagno. He was a pupil of Torretto, a well-known Venetian sculptor. His talent was recognised early—he secured his first commission for an *Orpheus* and *Eurydice* before leaving Venice for Rome. Canova attempted to escape from the bad traditions of his time, and he may be regarded as a pioneer of neo-classicism. Among his best works are a statue of Pauline Borghese whom he represented as *Reclining Venus*, his *Cupid* and *Psyche* in the Louvre and *Perseus with the Head of Medusa* in the Vatican.

**Canrobert**, François Certain (1809-1895) Marshal of France is chiefly known for the part he played in the Crimean and Franco-German Wars. He was present at the battle of Alma (1854) and the siege of Sebastopol, being for a time Commander in Chief of the French Army. He served at Magenta and Solferino in 1859 and won great distinction in the battle of Gravelotte during the Franco-German War when he commanded the 6th Army Corps but was taken prisoner at Metz in 1870. Senator 1876-95.

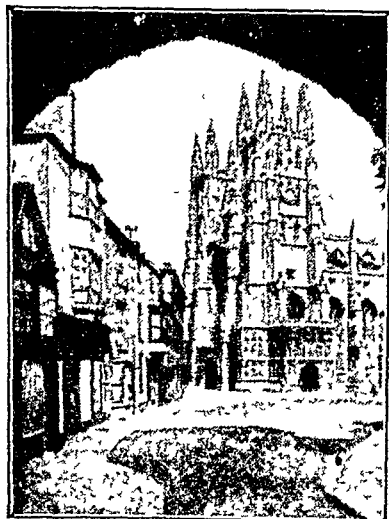


**Cantabrian Mountains**, a range c 300 m long, extending across the N of Spain. Several peaks are above 7000 ft, and one important river, the Ebro, has its source there. There are valuable coal deposits.

**Cantacuzene**, Byzantine family whose most famous member was John, joint emperor 1347-54, who after his abdication wrote a History of his times. His descendant Sherban C. (1640-88) published the first Rumanian Bible in 1688. Gheorge Cantacuzene (b 1837) held Cabinet office, was President of the Senate in 1892, and Prime Minister, 1899 and 1905-7.

**Cantal**, department in the South of France. It is a fairly mountainous district with several peaks upwards of 6000 ft, including the Plomb du Cantal, Puy Chavaroché, and Puy Mary. There are some good agricultural areas producing rye and dairy produce, the chief mineral is coal. There are no notable manufactures. Area, 2200 sq m, pop 198,000.

**Cantaloup**, see MELON



Canterbury Cathedral

**Canterbury**: (1) English city and county borough, seat of the Primate of all England, situated on the R. Stour 60 m ESE of London. It occupies the site of Durovernum, a Roman town of some importance. St Augustine was received here by Ethelbert, King of Kent, in A.D. 597, and the city has ever since been the centre of Christianity in England. St Martin's church is said to date back to the 6th century. The Cathedral, consecrated by St Augustine, was destroyed in 1067 by fire, and the new building was burnt in 1174. Much of the existing work dates from 1175-80. The existing nave and transepts were built in 1379-1400. The towers are still later. The city has a population of 24,000.

(2) District in South Island, N.Z., area about 14,000 sq m. Of this the great plain from the mountains to the coast has excellent soil and is noted for its agriculture, sheep farming (Canterbury lamb) and wheat growing are the most important, and there is valuable dairy produce. Christchurch is the capital. Pop c 230,000.

**Canterbury Bells** are among the most showy of hardy biennials for the garden. They bear a number of large bell-shaped, brightly coloured flowers, on an erect stem, springing from a rosette of dark-green leaves. Cut back after the first flowering they will bloom a second time. Seed should be sown in May, in sandy soil, in a shady place, and the plants transferred the following spring. Blue, mauve, rose, and white varieties are obtainable.

**Cantharides**, a species of beetle native to S. Europe, being found in Spain, France, and Italy. They are of commercial value on account of the presence in them of *cantharidin*. This substance occurs chiefly in the wing cases, and is most abundant in the full-grown insect. It is used in medicine in a number of forms, of which the tincture is the most important, the very small dose needed (6 minims) indicates its extreme activity. Taken internally in any but small

quantities it causes severe gastro-intestinal irritation. Externally the part affected becomes warm and painful. As a drug it is used as a counter irritant but the nature of its action is not fully understood.

**Cantharus**, Greek form of drinking cup with two handles and a long foot. In Boeotia fine specimens were produced in a black glaze with coloured decoration.

**Canticles** Book of, an Old Testament book, also called the Song of Solomon though Solomon did not write it. Authorities disagree as to whether it is allegory or lyrical poetry innocent of hidden meaning.

**Cantilène** [*pron* KANTILAN] is a term applied to the earliest form of French poetry half lyric and half epic presumably intended to be sung to a contemporary tune. The earliest extant example is the *Cantilène de Ste Lulaise* (10th cent.) and others are the *Vie de St Alexis* and the *Contes Pieux*. It may be that it was from such poems that the *Chansons de Geste* were developed.

**Cantilever** a mode of construction by which a load can be supported over a free space. It consists of a beam carrying the load at one end supported at some midway point and is cured from tilting upwards at the other end either by a balancing load or by tension members. Cantilever construction is largely used in buildings especially in the galleries of a modern theatre since by its use the necessity of employing obstructing pillars is avoided. Such construction is necessarily expensive on account of the large amount of steel required for the cantilever. The principle is also employed in bridges (q.v.) and cranes (q.v.).

**Cantilupe** Thomas de (1187-1192) canonised as St Thomas of Hereford in 1205 by John P.A. Chancellor of Oxford University in 1206. Cantilupe was a supporter of Simon de Montfort and became Chancellor of England in 1205 until the death of his leader. He was made Bishop of Hereford in

1275 and was the friend and adviser of Edward I and of the Archbishop of Canterbury. Miracles were alleged to occur at his tomb in Hereford Cathedral. Feast day Oct 3.

**Canton**, the name given to each of the 22 provinces which constitute the federal republic of Switzerland. Each has its own local government, taxation and domestic policy, foreign and national policy being directed by the Central Government.

**Canton** (1) Chinese city capital of the S.E. coastal province of Kwangtung. It possesses a number of workshops and factories, wide streets and public parks, making it one of the most progressive commercial cities in the country. For many years Canton was the only centre of British trade with China and it was from here that tea was first imported into England. Canton has been the scene of many upheavals, both political and social, and it was through the leadership of that able Cantonese statesman Sun Yat Sen (q.v.) that the People's Party or Kuomintang was formed whose aims were reconstruction on an ambitious scale. The commercial importance of Canton has waned with the development of Hong Kong. Chief productions: silk and rice. Pop. 900,000. (2) Important manufacturing centre in Ohio U.S.A. about 65 m S of Cleveland. Produces steel goods of all kinds, paints and bricks. The city lies in an agricultural district and is well served by railways. Its growth has been almost entirely in the present century. Pop. 10,000.

**Cantonment**, the quartering of soldiers in small parties among the private houses of a neighbourhood. See also BULLETIN.

**Canute** (Cnut) (c. 905-1035) King of England 1017-1035 and King of Denmark surnamed Canute the Great. He played an important part in founding the English nation. He was the son of Sweyn Forkbeard, King of Denmark, who invaded England accompanied by his son and conquered Wessex in 1013 driving King Ethelred

to Normandy. King Sweyn died in the following year, and Ethelred re-established himself, driving Canute back to Denmark. His triumph was short-lived. Canute mustered a strong fleet, and returned in 1015, subduing the country so completely that he was declared king on the death of Ethelred in 1016. London, however, remained recalcitrant, recognising the sovereignty of Edmund Ironside, Ethelred's son and heir. Honours remained even, and after Canute's victory at the Battle of Assandune, Essex, a peace conference arranged a compromise. Henceforward Canute would reign over Mercia and the N., and Edmund was to be King of E Anglia, London, and Wessex. This agreement was maintained until the death of Edmund in 1017, when Canute was elected King of the whole of England.

Canute reigned wisely and well, displaying great administrative gifts and unifying the contending kingdoms. He made no attempt to impose foreign ideas or legislation, but fostered all that was good in Anglo-Saxon tradition, and worked in close agreement with the leaders of the Anglo-Saxon Church. Personal piety and religious fervour marked his later life, as shown by his pilgrimage to Rome to the coronation of the emperor, Conrad II, by his rebuilding of the famous church at St Edmundsbury, and by the well-known tale of his rebuke to his sycophantic courtiers in the matter of the rising tide.

In 1026 a Swedish and Norwegian invasion threatened Denmark. Canute routed the aggressors in a naval battle, and established his rule over a great part of Norway. He died at Shaftesbury in 1035, and was buried at Winchester. He was succeeded by Harold I.

**Canvasback Duck**, a N. American duck of delicate flavour, closely allied to the pochard (*q.v.*)

**Canzone**, a variety of lyrical poem in Italian literature, written in not more than fifteen stanzas, and ending with a half-stanza like an envoy (*q.v.*)

**Capablanca, José R.** (b. 1888), chess-player, born in Cuba, and educated at Columbia University, New York. He became chess-champion of the world in 1921, succeeding Lasker, and held the championship until defeated in 1927 by Alekhine. He has published several works dealing with chess strategy.

**Cape Ant-Eater**, *see* AARDVARK

**Cape Breton Island**, detached portion of Nova Scotia, forming a large island divided from the mainland by the strait of Canso. Several lakes, of which the Bras d'Or is the largest, are joined to the coasts by canals, thus dividing the island into two parts. To the N. the surface is hilly, and in the S. it consists of plains and low hills. The coast is much indented and has several excellent harbours, that of Sydney (the capital) is one of the finest in Canada.

There are rich deposits of coal, which provide a large revenue, and slate, marble, and limestone are all quarried. Timber and fisheries are valuable. Agriculture is mainly for local consumption, except dairy produce. Industries are ship-building, and iron and steel manufacture.

The district is believed to have been known to Icelandic and Norse explorers, and the headland on the E. coast is said to have been reached by Cabot in his voyage of 1497. It was first settled in the early 17th cent. Later the territory was ceded to France. It was several times captured by the British, and was finally annexed to Nova Scotia. Area, 3115 sq. m., pop. c. 130,000 (Sydney, 22,500).

**Cape Coast**, W. African town on the Gold Coast, British W. Africa. It was first settled by the Portuguese in the early 17th cent., and became a powerful fort, but it is now unimportant. Pop. 15,000.

**Cape Colony**, *see* CAPE OF GOOD HOPE.

**Čapek, Karel** (b. 1890), Czech dramatist and writer, with a subtle sense of humour and satire. Several of his books have been translated into

English also two of his plays *Rossum's Universal Robots (R U R)* and *And so Ad Infinitum (The Insect Play)* which when performed in London (1923) met with success. The first has introduced a new word (robot) into the English language. Capek's plays are generally fantasies on strong scientific or technological themes. His brother Josef has often collaborated with him in writing and illustrating.

**Capella, see CONSTELLATIONS**

**Cape of Good Hope** the cape discovered by Diaz on the S.W. extremity of Africa originally called the Cape of Storms. It has given its name to the province (*qv*).

**Cape of Good Hope Province** the most S. portion of the Union of S. Africa formerly known as Cape Colony. It is bordered by the Atlantic and Indian Oceans and on the N. by Natal, Basutoland, the Orange Free State, the Transvaal, British Bechuanaland and S.W. Africa. Its natural features fall roughly into four divisions: the coastal plains, the Little Karroo, the Great Karroo and the tableland to the S. end of the great S. African plateau. These divisions are separated by mountains running roughly parallel with the coast. The most S. range includes the Outeniquas, Zonderende and Drakenstein Mountains; between the Little and the Great Karroo are the Zuurberg, Winterhoek and Zwartberg; and to the N. of the Great Karroo are the Nieuwveld, Sneeuwberg and Stormberg ranges. In the hilly district E. of the Great Kei are the Drakensberg Mountains. The most important rivers are the Orange, the Great Fish, the Great Kei, Olifants, Sunday, Breede, Buffalo and Vaal; very few of the rivers are navigable.

The climate is healthy and rather bracing. Rainfall is fairly plentiful in the coastal plain, but the succession of mountain ranges causes some of the inland districts, especially the Karroos, to suffer severely from drought. Temperature varies from moderate to hot according to altitude. Vegeta-

tion is conditioned by rainfall: much of it is shrub and small hardy trees while in the N.E. are forests containing ironwood, lemonwood and yellowwood. The province was at one time very rich in animal life, but the spread of cultivation and civilisation has either exterminated or driven them further N. The species that remain include various types of deer, leopards, wolves, wild cats and hares. There are many snakes, a few crocodiles, various birds of prey including the eagle and hawk and several kinds of fish. Domestic animals including cattle, sheep and dogs thrive.

The white population is fairly evenly divided between English and Dutch, there being in all some 650,000. The natives are mainly Bantus with some Hottentots and Griquas; the total population is about 1,800,000. The principal towns, most of which are on the coast, are Cape Town, Port Elizabeth, East London, Grahamstown and Kimberley. The other towns occupy such positions as make them natural railway or market centres.

The pastoral industry is the most flourishing; the lack of rain and good soil in many places making agriculture difficult. There is a large fruit producing district in the S.W. and some wheat is grown, but the raising of cattle, sheep and horses is of the greatest importance, a large quantity of wool being exported every year. Ostrich farming has declined considerably and the fisheries, owing to the lack of good small harbours, are not so successful as they might be. The chief mineral wealth comprises diamonds, which are mined in the Kimberley and Barkly West districts. Copper, tin and some coal are found.

Agriculture is in process of development. Among new industries are textiles, fruit-canning, bootmaking, engineering and building. The most important exports are indicated by the natural resources and include diamonds, wool and fruit. Education is of a good standard and as highly organised as the scattered

districts allow There are about 2,400 schools for non-European children Missionary work is vigorously pursued The province is divided into 128 municipalities, each governed by a Mayor and elected councillors, administration is carried on by an administrator appointed by the Governor-General, assisted by a Provincial Council of 58 members chosen by popular franchise every 3 years Four members of the Council form an Executive Committee, with the administrator as chairman The province sends 8 members to the Union Senate, and 58 to the House of Assembly

The Cape was first discovered in the late 15th cent by Diaz (*qv*), and rounded about ten years later by Vasco da Gama (*qv*) The Dutch East India Company founded a settlement in 1652 on Table Bay, but little progress was made, as the Company was a trading and not a colonising concern After France's victory over Holland in the Napoleonic Wars, Britain took over the colony, and after the Battle of Trafalgar held it until the treaty of 1814, when it was formally ceded to her The history of the next cent is one of native wars, and troubles with the Dutch The natives resented the steady influx of settlers and the loss of their lands, and the Dutch, hard hit in the early days by the liberation of the slaves, first obstructed, and then moved N to found new colonies The history of the province is interlinked with the general history of S Africa, and is fully dealt with under that heading

**Cape Race**, the extreme S E point of Newfoundland Navigation is dangerous, and the spot is marked by a famous lighthouse

**Capet**, *see* SPICES AND CONDIMENTS

**Capercaillie** [KA-PŪ-KĀ'-LYI], sometimes also called Cock-of-the-Wood, is the largest of the grouse tribe, resembling the blackcock (*qv*) in its naked toes This handsome bird was formerly found in Scotland and Ireland, but was exterminated in the 18th century. Later it was re-established in Scotland

from Scandinavia, and the birds now found in Great Britain are the descendants of that foreign stock Young birds in the autumn, after feeding on the fruit and berries of the bilberry, are excellent eating, but in winter they eat pine-needles, which gives their flesh a taste of turpentine

**Capernaum** [KA-PE'-NĀ-ŪM], ancient town of Palestine on the N shore of the Sea of Galilee, according to the Gospel stories it was several times visited by Jesus Excavations have identified it with the modern village of Tell Hūm

**Cape St. Vincent, Battle of:** (1) June 17, 1693 Admiral Sir George Rooke, convoying a fleet of English and Dutch merchant ships to the Mediterranean, was forced to retreat before a French fleet under Admiral Tourville (2) French Revolutionary Wars, Feb 14, 1797 a British fleet of 20 vessels totally defeated the Spaniards

**Capet**, the name of the French Royal Family of 987-1328 The house was founded by Robert the Strong (d 866), Count of Anjou and Blois, of his two sons, Odo was chosen Frankish King by certain districts in opposition to the Carolingian monarch In 987, Hugh Capet was elected Frankish King, and his descendants ruled until 1328, when the second Capet or Valois house succeeded them to the throne and to the Duchy of Burgundy (*qv*). The branch comprising the Dukes of Burgundy sprang from Robert (grandson of Hugh Capet), who founded the house in 1032 His descendants ruled until 1361 as Dukes of Burgundy. Branches of the Capet house ruled in France until the Revolution of 1789, and the thrones of Naples, Hungary, Navarre, and Constantinople were at times occupied by members of the house

**Cape to Cairo Railway**, a projected N and S trans-continental railway across Africa, originally conceived by Cecil Rhodes as a link between the various British territories Of a total length of c. 5600 m., c. 2600 have been built from the Cape and c. 1500 from



usually as money, or in terms of money. Thus instead of regarding his factory and its machinery as capital, he regards their money value as his *fixed capital*, and the money he has on hand to buy raw materials, pay wages, etc., as his *working capital*.

The capital of a limited liability company represents the nominal value of the total shares of the company. The *authorised capital* is the total amount the company may issue under the terms of its articles of association. The *issued capital* is that part of the authorised capital which has actually been issued. The *paid-up capital*, the proportion of the issued capital paid into the company (some companies, especially banks, do not have their capital fully paid-up, shareholders are then liable to a call to pay up the balance, or a part, of the unpaid capital issued to them). See also COMPANIES, JOINT STOCK, and CORPORATIONS.

**Capitalism**, a name applied to the predominant modern economic system, in which "capital," or the machinery for producing wealth, is controlled by private enterprise. It is usually used in contrast to the word "Socialism" (*qv*), which signifies the control of all capital by the society or State. The criterion of capitalism is sometimes held to be the employment of labour by private individuals or enterprises. But it is usually represented more narrowly as that particularly modern and large-scale form of capitalism associated with industrialism, joint-stock control, and a mass of wage-earning labour.

In the latter sense capitalism may be said to be a product of the Industrial Revolution, foreshadowed by the fierce individualism of the Renaissance, with its idea that each man should be free to seek fortune how and where he would. The increasing foreign commerce of the 17th and 18th centuries, handed over to monopolistic private companies, and the adaptation of banking to new conditions with free flow and exchange of cheap money

and credit, were two factors which paved the way for the new system. The E India, Hudson's Bay, and other companies accustomed people to the idea of associations of persons putting down large sums of money to participate in trade, with the prospect of handsome profits if successful, of partial or total loss of their investment if unfortunate. This conception is the root of modern capitalism.

The coming of machinery enormously accelerated the tendency to large-scale finance. The amount of money necessary to enter business or trade rose rapidly as the factory replaced the work-shop, the steamship the sailing-vessel. On the other hand, as transport and communication became more speedy risks diminished, and the return on money invested became more calculable and more certain. It was no longer necessary to demand such high rates of interest, and money flowed with increasing ease. The introduction of the joint-stock company system, the association of large numbers of contributors pooling their small "shares" of capital in return for a proportionate division of profits, proved eminently suitable for the new industrial development.

Fixed interest return enabled those possessing small sums which they could ill-afford to lose to participate, and to become minor capitalists. Yet in spite of this freedom to all comers, the tendency for the units of industrial organisation to merge and expand in size applied also to finance.

In this way "capitalist" society developed into three distinct classes. The smallest consists of true "capitalists," holding comparatively large amounts of productive capital. The next comprises the "bourgeois," those in minor administrative positions or drawing moderate incomes from invested moneys. The third class, the majority of the population, constitutes the mass of wage-earning labour, having no capital interest but subsisting on weekly payment in return for their services in the production of

wealth organised by others. This composition of society is prevalent with different proportions of each class in all industrialised capitalist communities.

From its earliest stages and for a long time such industrial capitalism was based on the theory of free competition. This striving one against the other with the reward of wealth for the most vigorous and efficient and ruin for the weakling and incompetent brought both good and bad effects. It ensured a tremendous advance of material knowledge, well-being and comfort and an unsurpassed exploitation of inventions, resources and money for the production of new wealth. It greatly increased the amount of goods available to the human race. On the other hand it bred a certain ruthlessness in the pursuit of success and exalted the power and importance of money as a general good.

The worst of these evils passed. Humanitarian reaction rescued workers from a fifteen hour day on starvation wages and alleviated their brutal and sordid conditions. Competition grew milder. Higher wages and greater leisure gave even the lowest classes a larger claim on the sum of goods and pleasures. State supervision and social services paid for by taxation of the rich alleviated many of the ills that had gone before. After 100 years of industrial capitalism the standard of living of all classes in the community is immeasurably higher than before.

Besides encouraging the continuous modernisation of the machinery of production and the constant increase of the total of wealth, capitalism has other services to render. The financial adjustments of the money market ensure that the most profitable forms of production shall be first exploited; that the investment of capital shall move freely from one industry to another from this country to that according to which shows greatest promise. Under capitalism the hidden

wealth and productive capacity of distant underpopulated and impoverished lands have been exploited as they never could have been if each State remained entirely responsible for its own welfare. Railways, mines, plantations all over the world owe their existence to capitalism. It must be repeated that leisure, health, expectation of life, enjoyment of goods, avoidance of suffering and opportunities of happiness are all greater and shared by a larger proportion of the race than at any known period of the world's history.

**Capital Letters**, in writing or printing distinguished from other letters by their greater size and in most cases by a difference in their form which is derived from the lettering of ancient Roman inscriptions. They are used initially at the beginning of a sentence for proper names for the beginning of a line of verse for quotations and for titles of various kinds and for other purposes. In typographical language they are known as upper-case letters or caps. See ALPHABET.

**Capital Levy**, a scheme for the payment of war costs by a levy on all private fortunes first suggested in the House of Commons in Nov. 1914. It was further advocated by individuals in all parties as the War progressed on the grounds that huge fortunes were being made from munitions etc. and that wealth should be conscripted as much as life. In 1919 it was again seriously brought forward as a way of paying off the national debt. The Board of Inland Revenue drew up a limited scheme in 1919 which was adapted and developed by the Labour Party and retained in its political programme until 1927. All fortunes over £5000 were to be liable; the levy payable varying from about 1 per cent on that amount to over 50 per cent on £1 000 000. The scheme was rejected by the Colwyn Commission in 1924.

**Capital Market**, the market in stocks and shares, bonds and debentures. The term is used chiefly in connection



with the flotation of new issues—e.g. when Australia or Canada raises a new loan in England, or when a foreign company is financed by the floating of shares or debentures in this country, it is said that the money has been raised in the London capital market. This term distinguishes the market in long-term capital, represented by securities issued to the public, from the *money market*, which has to do with short loans made by banks and other financial institutions to finance the movement of goods, etc. See also ISSUING HOUSES, BANKING AND CREDIT

**Capitol**, the official centre of Ancient Rome, a spot sacred to Jupiter, with a temple and a fort. The term is now applied in the U.S.A. to the seat of the Federal Government at Washington, and also to the administrative centres of each state.

**Capitulation:** (1) The treaty which determines the terms of surrender of a besieged military force. (2) Treaty by which the subjects of one State, while residing in the jurisdiction of the other party to the Treaty, enjoy immunity from the laws of the latter and remain within the jurisdiction of their home State. Such capitulations—all made with States in Asia or Africa—have been in force for several centuries, but since the World War have mostly been abolished, e.g. in Turkey in 1914, in Siam in 1927, in Persia in 1928.

**Cap of Maintenance**, also termed *chapeau*, or *cap of dignity*, or of *estate*, heraldic symbol of high dignity. As



Cap of Maintenance

part of the royal insignia, it is carried before the King at his coronation.

**Caporetto**, small Italian town on the Isonzo, where between Oct 24 and Nov 18 1917, the Italians defeated the Austro-German Armies. The retreat, which began with the loss of Caporetto, was at first very disorderly, and the German forces penetrated

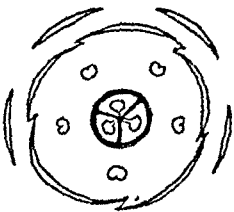
to the line of the Piave. British and French reinforcements were sent to stiffen the Italian defence, but the German advance was prevented chiefly by the flooding of the R. Piave.

**Cappadocia** (anc. geog.), a district lying in N.E. Asia Minor, and of considerable though uncertain area. First under Persian rule, it became later an ally of Rome and then a Roman province. With the coming of Christianity it gradually became inhabited by Armenians, and is to-day within the confines of Turkey.

**Capri**, Italian island at the most S end of Naples Bay. The soil is fertile, and produces wine and fruit, but the principal source of revenue lies in the great number of visitors, the island being a famous beauty spot. The most outstanding feature of the island's rocky coastline is the famous Blue Grotto, which takes its name from the blue refractions to be seen in the cavern. It is of historic interest from the residence in it of Tiberius, the remains of the 12 villas he built still exist. The two towns are Capri and Anacapri. Pop. 7000.

**Capricornus**, see CONSTELLATIONS.  
**Caprifoliaceæ** (bot.), the honey-suckle and elder family, of which the guelder rose and snow-berry are cultivated members.

**Caprivi de Caprara de Montecuccoli**, **Georg Leo Von**, Graf (1831–1899), Prussian soldier and Chancellor of Germany (1890–4). Son of a German lawyer, Caprivi joined the Army in 1849, and served with distinction in the Franco-Prussian War of 1870. Although he subsequently held the posts of Chief of the Admiralty and Commander of the 10th Army Corps, he



Caprifoliaceæ Diagram of Flower

was not well known when he succeeded Bismarck as Chancellor and Foreign Minister in 1890. By wise negotiations with Great Britain he consolidated and extended the colonial possessions of Germany in Africa but his exchange of Zanzibar for Heligoland (*qv*) deeply offended those who desired to see Germany possessed of extensive African territories and to adopt a challenging attitude towards England. This and conflicts with the Agrarian Party who mistrusted both Bismarck and Caprivi led to his downfall and the Emperor finally dismissed both him and Count Eulen-berg Prussian Minister of the Interior in 1894 when they fell out over amendments to the criminal code.

**Capicum**, a plant of several species whose fruit supplies cayenne pepper and chillies and is valuable in medicine. *See also* SPICES and COMMODITIES.

**Capstan**, apparatus used on board ship and elsewhere for exerting pull on ropes or cables. It consists of a drum which turns round a vertical axis. The cable is usually taken around it once or twice and the slack which forms as the drum is turned by hand or power is taken up by hand. The old capstans were worked by manual labour the crew operating them by long bars. On all modern ships steam or electric capstans are fitted.

**Capstan Lathe**, *see* LATHE.

**Capsule** a dry fruit formed from several carpels and containing many seeds. Examples are the poppy and the foxglove. *See also* FRUIT.

**Captain**, in the Royal Navy an officer ranking immediately below a rear-admiral in the mercantile marine the commander of any vessel. In Army captain ranks between a lieutenant and a major and commands a company.

**Capua**, historic Italian town situated 20 m N of Naples. It dates from the 9th cent. and the cathedral though much modernised is of architectural importance. A few miles away is the site of the ancient city founded by the Etruscans in the 8th cent. B.C. and

long occupied by the Romans. It has a Roman amphitheatre. Pop 14 000.

**Capuchin** a S American monkey of which there are several species some with the crown of the head hairy and crested others nearly bald over the forehead the latter being the source of the popular name on account of their fancied likeness to monks. Capuchins have prehensile tails and on account of their intelligence engaging manners and hardy constitution are the most popular as pets of all the American monkeys.

**Capuchins** a branch of the Franciscans (*qv*) friars adhering strictly to the rule of St Francis. During the 17th cent they became entirely independent of the main body. Their name arises from their pointed hood (Ital *capuccino*).

**Capybara**, or *Carpincho* is the largest of the rodents (*qv*). It



Capybara.

inhabits S America frequenting river banks in the forest often in herds. It is the size of a pig and is covered with a coat of stiffish brown hair. Like the cavies (*qv*) to which it is related it has a large head but a mere stump of a tail. When frightened it takes to the water being a good swimmer. Strictly vegetarian in diet it sometimes does considerable damage by invading cultivated ground.

**Carabinieri** in the 17th cent French mounted troops armed with carbines used especially for reconnoitring despatch-carrying etc. A similar British regiment was formed in 1680 and armed with carbines in 1692 (6th Dragoon Guards). They resembled the German *Reiters*. *See also* ARMY.

**Caracal**, a wild cat related to the lynx (*q v*), but with a longer tail, and no crests on the cheeks



Caracal

It is fawn or brown in colour, and is found in bush country in Africa and S W Asia. It is tamed by the Arabs for hunting small mammals and birds.

### **Caracalla, Marcus Aurelius Antoninus**

(A D 183-217), Roman Emperor (211-17), succeeding his father Septimius Severus, was born at Lyons (Lugdunum), and, with his brother Geta, accompanied his father to Britain in 208. Three years later, Severus having died at York (Eboracum), Caracalla and his brother Geta returned to Rome to be installed jointly as emperors, but Caracalla murdered his brother and established himself alone on the imperial throne. Barbarity and high taxation were the chief features of his reign. He enfranchised the free inhabitants of the whole empire, though only as a means to tax them. He left Rome the richer by a number of fine buildings (including the famous baths). Caracalla was murdered by his successor, Macrinus.

**Caracara**, several species of hawk-like birds found in S and Central America, having the habits of vultures. They differ from most birds of prey by their activity on the ground, their gait recalling that of a pheasant. From their feeding habits they are sometimes appropriately called carrion hawks.

**Caracas**, capital city of Venezuela, situated about 23 m S of the Port of La Guaira. Important trade centre. Public buildings include the cathedral, the President's residence, the University, and the National Library. Pop 134,000.

**Caractacus** (properly *Caratacus*); British chieftain who opposed the Roman invasion during the 1st cent A D. Caractacus led his men valiantly against the Roman forces under Aulus Plautius (A D 43-7) and, after being defeated at Colchester, took refuge in S Wales. He was finally captured in A D 50 and taken to Rome, but was granted his life and liberty by the emperor Claudius.

**Caramel**, see SWEET-MAKING.

**Caravaggio, Michelangelo Ameghida** (1569-1609), Italian painter, whose surname was derived from his birthplace, Caravaggio, in Lombardy. Caravaggio was a painter of tremendous energy, of the extreme naturalistic school, and his chief characteristic is his exaggerated use of light and shade. Among the best examples of his work are his *Entombment of Christ* in the Vatican and *Christ at Emmaus* at the National Gallery. His life was as turbulent as his paintings, and he died of wounds and fever on the beach at Pontercole, after spending some time in Naples, Malta, and Sicily, avoiding arrest for manslaughter.

**Caravaggio, Polidoro Caldara da** (1495-1543), Italian painter, born at Caravaggio, from which his name is derived. He was responsible for decorative friezes and other ornamental work in the Vatican, and was a disciple of Raphael. He lived and prospered for some time at Messina, but little of his work remains, though etchings of his paintings by Alberti and Bartoli and others exist, and his *Christ Carrying the Cross* hangs in the Gallery at Naples. He was robbed and murdered in Sicily.

**Caravan**, a train of merchants with their merchandise travelling together for security against marauders. In the East the caravan was a common form of transport, and recognised caravan routes became established, often over great distances of desert. Camels and mules are used, as many as 500-1000 forming a single caravan. Each merchant in a caravan trades separately, but *en route* the whole is in

charge of a leader or *rás*. The principal caravan countries are Arabia the Sahara Persia and Central Asia. With the coming of the railway and the motor-car caravan trade has dwindled and many important routes have been discontinued (see TRANSPORT). The rough unfurnished caravan halts (built about a courtyard and at which beasts can be stabled) are known as *caravanserais*. The name caravan is also nowadays given to a small dwelling on wheels used by gipsies or for pleasure.

**Caravel**, a broad beamed vessel with a double tower at the stern and a single one in the bows used chiefly by the Spanish and Portuguese for their long voyages of exploration in the 15th and 16th cents. and notably in Columbus's expedition to America.

**Caraway**, the seed of a plant belonging to the family Umbelliferae natural in England. The plant has tall fleshy stems large leaves and large umbels of white flowers. The seeds are used for flavouring in cakes and bread. See also SPICES AND CONDIMENTS.

**Carbamide**, an alternative name for urea (qv).

**Carbides**, substances that are compounds of carbon with a metal. Not all metals give carbides and of those obtainable the only ones of importance are calcium carbide which is used in the manufacture of acetylene (qv) and the carbide of iron which is known as *cementite* and occurs in various types of cast iron. Many of the metallic carbides are decomposed by water to give hydrocarbons in addition to calcium carbide already mentioned aluminium carbide gives methane whilst thorium and uranium carbides give mixtures of hydrocarbons. Other metals that form carbides are lithium beryllium chromium tungsten and molybdenum.

**Carbine** a short fire-arm developed at the end of the 16th cent. and used especially by mounted troops from 1850 onwards (see CARABINIERS). The form still persists as a shortened and modified rifle.

**Carbohydrates** are an extremely

important group of organic compounds composed exclusively of the three elements carbon hydrogen and oxygen. The two latter occur in the majority of carbohydrates in the same proportions as in water hence the name. The individual chemically distinct carbohydrates may be distinguished by the termination *ose* which they all carry e.g. sucrose fructose etc. Chemically they may be divided into the sugars and the non-crystallisable carbohydrates such as cellulose and starch.

The sugars may be divided into the *monosaccharoses* which contain 6 or 6 carbon atoms i.e. compounds of the formula  $C_6H_{12}O_6$  and  $C_6H_{12}O_5$  respectively and the *disaccharoses* which are of the general formula  $C_{12}H_{22}O_{11}$ . The non-crystallisable carbohydrates are classed as *poly-saccharoses* of the formula  $(C_6H_{10}O_5)_n$ . There also exist the intermediate groups of the *tri* and *tetra saccharoses* containing 18 and 24 carbon atoms respectively.

On examining the above formulas it will be seen that the polysaccharoses are (apparently) formed from the lower members (monosaccharoses) by the elimination of a molecule of water i.e.



the reverse process (hydrolysis) can also take place and thus the lower sugars can be obtained from substances like starch and cellulose a fact of extreme practical importance.

The great majority of the sugars exhibit optical activity and this greatly increases the number of isomerides possible. The optical activity of the sugars is of commercial importance as a method for determining the amount present in sugar-containing substances (see SACCHARIMETRY). The large majority of the naturally occurring sugars are dextro-rotary.

The principal monosaccharoses are glucose (grape-sugar) fructose (fruit sugar) and galactose (qv) all of which are hexoses i.e. contain 6 carbon atoms. The only important sugar

containing 5 carbon atoms (pentose) is xylose

Of the disaccharoses by far the most important is sucrose, which is the sugar (*qv*) of commerce, and occurs principally in the sugar-cane and sugar-beet. Other important disaccharoses are lactose or milk sugar and maltose or malt sugar (*qv*)

The tri- and tetra-saccharoses are so far not of industrial importance

The polysaccharoses include a number of products of first-rate commercial significance. Starch (*qv*) is a very widely distributed polysaccharose which on hydrolysis yields sugars, the actual sugar yielded depending upon the hydrolysing medium employed

The principal polysaccharose is, however, cellulose (*qv*), which is found as the chief constituent of all vegetable matter. In addition to its numerous industrial uses as such, cellulose is also the indirect source of our meat supplies, since it forms a large proportion of the food of cattle

**Carbohydrates in Food** The carbohydrate-containing foods may be classified as follows

**Sugars** honey and syrup, treacle, and sugar in fruits

**Starchy foods** cornflour, flour, macaroni, rice, barley, oatmeal, potatoes (carrots and parsnips contain a little), bananas, (cooked) bread, cakes, biscuits, steamed puddings, etc

**Cellulose foods** fruits and vegetables

A definite quantity of these substances is required daily by the human body, to provide it with heat and energy, but an excess of these foods may lead to obesity or diabetes and, in a child, to rickets, perpetual colds in the head, and a generally flabby muscular condition

The effect of moist heat, i.e. boiling or steaming, is to swell the starch grains and to make them soluble and digestible. Dry heat, as in baking, converts the exterior into a soluble substance, *dextrin*

**Carbolic Acid**, an alternative name for phenol (*qv*)

## Carbon. See ELEMENTS

Carbon is a non-metallic element extremely widely distributed in nature, both in the elemental and combined states. It is essential to all forms of life, and forms such an enormous number of compounds (about a million are known) that their study is a science in itself (see CHEMISTRY, ORGANIC)

Carbon is found free in nature in two allotropic modifications, diamond and graphite, in addition a third form, amorphous carbon, can be manufactured by burning various substances containing carbon in a limited supply of air

**Diamonds** are a crystalline form of carbon found in nature in various parts of the earth, the principal supply coming from S Africa. They have also been found in minute amounts in meteorites, and diamonds of microscopic size can be manufactured synthetically

**Graphite (Plumbago)** is another crystalline variety of carbon found naturally, and used for pencils. It is found in nature chiefly in Ceylon, Cumberland, and California, and can also be manufactured artificially by heating coke in the electric furnace

Graphite is an extremely soft compound, and as such is used to a considerable extent as a lubricant, either by itself or else mixed with water or oil. Graphite conducts electricity, and its resistance varies inversely with the pressure, it is therefore used for the manufacture of electrical resistances operated by a screw, on tightening the screw the amount of current flowing is increased. It is also employed for the manufacture of brushes for dynamos and motors, for arc-light carbons, and as an ingredient of polishes for iron and steel goods

**Amorphous carbon** can exist under a variety of names, such as lamp-black, carbon-black, charcoal, etc. **Charcoal** (*qv*) is industrially one of the most important forms

**Lamp-black**, which is used as a black pigment in paints and varnishes, is manufactured by the combustion of

carbon-containing fuels such as wax oil and principally natural gas in a limited supply of air. When prepared from natural gas the pigment is more often called *Carbon black*.

**Compounds of Carbon.** Since these form a branch of chemistry by themselves the more important will be dealt with under their own headings. For a description of other naturally occurring carbonaceous materials see **COAL** **PETROLEUM**. See also **CARBON TECHNICAL FORMS OF**.

**Carbon Technical Forms of.** The element carbon exists in at least three well-defined allotropic modifications—amorphous carbon, graphite and diamond (see **CHEMISTRY**).

Amorphous carbon is made artificially by two principal methods. The first consists in heating organic substances e.g. cellulose to a temperature at which they are completely decomposed. When cellulose is heated (see **WOOD DESTRUCTIVE DISTILLATION** or) much water is evolved as well as a number of other substances carbon remaining behind in the form of charcoal. Bones, blood, animal waste and many vegetable substances such as sea weed, peat, waste pulp and so on are similarly treated, the impure carbons obtained being termed *chairs*.

The second method of making amorphous carbon is by the incomplete combustion of hydrocarbon liquids or gases, many of these deposit carbon when strongly heated, a process called *cracking*, and we may regard incomplete combustion as the cracking of a hydrocarbon by heat derived from its own partial combustion.

Amorphous carbon has several uses in industry. It is by far the most important black pigment. For this purpose it is manufactured by both of the above methods, *lamp-black* and *carbon black* being made from the incomplete combustion of hydrocarbons and other oils, the first from liquid hydrocarbons, oils, fats and resins and the second from natural gas. Carbon black made in America by the partial combustion of natural gas

is an important ingredient in rubber goods such as tyres imparting tenacity, strength, toughness and high resistance to abrasion. Lamp black is used less and less for the finest purposes such as printing ink, but is largely employed as a black filler for the manufacture of hard carbon electrodes and motor brushes and for the coarser kinds of paint and stove polish. *Stove black* and *bone black* are chars, both of them being now made from bone which is first carefully freed from albuminous matter and fat. Various kinds of vegetable substances such as willow wood, yeast sawdust and wood pulp residue on heating yield charcoal which is suitable for use as a pigment; these are called *timber blacks* or *vegetable blacks*.

Another use for amorphous carbon of continually increasing industrial importance is as an adsorbent (see **COLLOID CHEMISTRY**). When *bone black* for instance is brought into contact with sugar-cane juice and many oils and a great number of other liquids it removes objectionable colouring matter and has long been used for this purpose. *Coconut shell charcoal* when carefully prepared has an extraordinary power of adsorbing gases and was first used during the war for protection against poison gas. The air is breathed by the wearer of a gas mask through a cylinder containing coconut charcoal and although it is in the cylinder for only a tenth of a second the quantity of a highly poisonous gas in the air is reduced to a fraction of one part per million. This substance is generally called *activated carbon*, the process of activation being generally performed by the action of steam and air at a high temperature. In all probability it consists in removing hydrocarbons which clog the surface of the charcoal. Activated carbon is now being employed for recovering benzene, benzol and other light hydrocarbons in all kinds of technical processes such as dry-cleaning and also for removing objectionable odours as in slaughter houses.

When carbon in any form is finely ground and subjected to great pressure, followed by heating to a high temperature, it becomes very hard, remaining amorphous unless the heating is carried to an exceedingly high temperature, when it is transformed into graphite, if some silica is present. Until this point is reached the material becomes harder, the higher the temperature to which it is subjected. This material underwent an enormous development as the demand for electrodes for electric furnaces and electro-metallurgy (*qv*) arose. A further development took place when the virtues of carbon brushes for electrical machines were discovered, and the use of dry batteries for portable lamps, made possible by the invention of the tungsten filament, has led to an enormous demand for moulded carbon rods of a low quality for these batteries.

*Graphite* is found as a mineral, and this is still made use of to a very large extent, but its purification presents great difficulties, since the mica with which it is usually associated is similar in mechanical properties. Graphite is made artificially on an enormous scale by the *Acheson process*, and is much purer than the average natural mineral. The transformation of carbon into graphite by intense heating in the electric furnace (*qv*) is rendered possible by the presence of silica, anthracite coal, containing about 10 per cent of ash, is used as raw material. It is used for lubrication, making graphite crucibles, and other refractories, and for many other purposes.

*Diamond* (*qv*) occurs naturally in many parts of the world. The various varieties are known as *hort* and *carbonado*. Diamond dust is used as an abrasive, and diamond dies or draw-plates are used for wire drawing (*qv*), especially in the manufacture of electric lamps, where its extreme hardness is indispensable. Small diamonds of good quality are used for cutting glass, it is necessary to use the natural edge of the crystal for this purpose.

*Carbonado*, small black diamond

used for industrial purposes. See also BORT, CARBON, TECHNICAL FORMS OR.

*Carbonari*, secret revolutionaries in Italy and France in the early 19th cent. They first came to the fore during the Napoleonic Wars, their aim being to secure freedom from foreign domination for Italy. In 1820 the revolution in Naples was instigated by the Carbonari, and in 1821 that in Piedmont. Carbonarist risings with the object of expelling foreign rulers and unifying Italy occurred in the Parma and Modena in 1830. This society prepared the way for the *Risorgimento* (*qv*). In France they played a smaller part, leading to risings in 1820 and assisting the July Revolution (1830).

*Carbon Black*, see CARBON, TECHNICAL FORMS OR.

*Carbon Compounds*. See CHEMISTRY, ORGANIC.

*Carbon Dioxide*, or carbonic acid, is a colourless, odourless gas, it can be liquefied under pressure, but the liquid cannot be preserved as such at atmospheric pressure even at low temperatures. The gas is, however, fairly easily solidified, and at atmospheric pressure this sublimes directly to the gaseous form at  $-78^{\circ}\text{C}$ . without the intermediate formation of a liquid.

Carbon dioxide is extremely widely distributed in nature, forming a small but fairly constant (about 0.03 per cent) proportion of the atmosphere. It is not by itself poisonous, in fact, it is essential to mammalian life, but as it is not a respirable gas, it causes asphyxiation by excluding oxygen.

Carbon dioxide finds a large number of uses in industry. It has of late become extremely popular as a refrigerant, the solid form being used for this purpose under the name of "dry-ice". It has the advantages of having, for a given weight, a very much greater cooling capacity than ice, and of disappearing as a gas instead of melting and making a mess. It may be noted that the ice-cream tricycles common on public roads mostly keep

their wares cold by the use of solid carbon dioxide. Solid carbon dioxide is sometimes also used as a local anæsthetic for very minor operations. Carbon dioxide is also used to a great extent in fire extinguishers especially those intended to fight oil fires where water would only spread the conflagration. In these machines sodium carbonate and a dilute acid are kept separate till the moment of operation and then mixed. The pressure of the gas formed directs the foam on to the seat of the fire.

Carbon dioxide is moderately soluble in water giving a solution that is faintly acid owing to the presence of a small amount of carbonic acid  $\text{H}_2\text{CO}_3$ . The amount of gas that can be dissolved is increased with pressure and such solutions are made in the form of "soda water" and in other carbonated beverages. Compressed carbon dioxide is also used to operate beer-engines by supplying the pressure necessary to raise the liquid from the barrels in the cellars to the serving bar. Physiologically carbon dioxide is of great importance owing to its property of stimulating the respiratory centres. Recent work has shown that the act of respiration is due not so much to lack of oxygen as to the presence of carbon dioxide. This property is being made use of by mixing 5 per cent of carbon dioxide with the oxygen that is used to stimulate respiration in surgical patients and in cases of asphyxia by drowning and electric shock.

Carbon Disulphide,  $\text{CS}_2$ , is a colourless evil-smelling highly inflammable liquid having a boiling point of  $46^\circ\text{C}$  and a melting point of  $-110^\circ\text{C}$ . It is manufactured by the direct combination of carbon with sulphur in an electric furnace. It is used to a considerable extent as a solvent and as an insecticide and vermin killer. It is also employed in the manufacture of carbon tetrachloride.

**Carboniferous System** so-called because it includes the principal coal-bearing beds is in Great Britain at

least the most important geological system partly by reason of its wide distribution and partly on account of the substances of economic importance it contains. The Carboniferous rocks are of the Upper Palæozoic age and



Britain in Lower Carboniferous Times (after Will.)

occur between the Devonian and Permian systems. They are mainly found in the N Hemisphere in Europe, Asia, N Africa and N America and occur in small patches in the S Hemisphere. They have been identified in these areas by fossil evidence but also exhibit a fairly uniform type of deposit.

In places they are difficult to separate from the Devonian below or the Permian above and in the United States where there is a big break in the middle of the Carboniferous deposits the Upper Carboniferous is grouped with the Permian and the Lower Carboniferous with the Devonian. The term Carboniferous being applied to the former group and therefore including the Permian. It is difficult to draw up a universally applicable table of main divisions of the



Carboniferous system, but the one most favoured on the Continent is

Upper Carboniferous	{	Stephanian
		Westphalian
		Lancastrian
Lower Carboniferous	{	Viséan
		Tournaisian

The last four names are sometimes applied to equivalent beds in England. There is no proved Stephanian in this country.

In Great Britain the mountain ranges of the Devonian period, except in Scotland, had been worn down when the Lower Carboniferous sea invaded the Old Red Sandstone lakes from the S. This sea was clear and shallow, and in it was deposited a great thickness of limestone, often called "Mountain Limestone." In the Lowlands of Scotland, however, material worn away from the mass of land forming the Highlands to the NW rendered the deposits sandy, and deposits of coal were formed. On the shore of this Highland land mass was a zone of volcanoes, which emitted sheets of lava.

Another land mass extended from SE Ireland through Central Wales to the Midlands, separating two main areas, in which the limestone was deposited, a "SW Province" in which beds are well exposed, in the Mendip Hills, and in the famous section of the Avon Gorge at Bristol, and a "N Province" with beds of greatest thickness in Lancs, but also well exposed in Derbyshire, W Yorkshire, the Lake District, and Northumberland.

The Lower Carboniferous of Europe occurs in Belgium, Germany, and Russia. Deposits have also been found in Siberia, China, and Japan, the United States, New Brunswick, and Nova Scotia, and the Viséan division at least in N. Africa and in New S Wales.

The Upper Carboniferous began to form in Great Britain at the close of the limestone period, when the sea shallowed, and a great river drained from the N and laid down deltaic flats

of sandstones and "grits," called the Millstone Grit, as far S as Staffs and Shropshire, while deposits of a similar nature were forming on coast-lines in Wales and Scotland.



Britain in Millstone Grit times (after Wills)

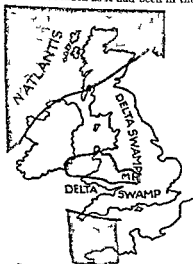
This still further silted up and shallowed the seas, and provided the conditions which led to the swampy forests of the Coal Measures. Heavy monsoon-like rains probably encouraged the growth of these forests, but periodic subsidence led to their being buried beneath masses of sediment, brought down by rivers. This is marked by the occurrence of a coal seam interspersed with deposits of sandstones and shales.

The Coal Measures were probably deposited over the whole of an area stretching from Scotland to the Midlands, but have since been removed in many districts by denudation. They are therefore now found in a number of isolated basins where they have been protected from weathering.

There are nearly 30 outcrops, large and small, of workable coal in Great Britain, the largest being those of S Wales, Lancashire, Yorks, Notts and Derby, Northumberland and Durham,

and Scotland. Workable coal is concealed under newer rocks in Kent. Coal Measures occur in Devon and Cornwall but are barren of coal seams. In Ireland they cover a considerable area but include no important coal fields though some are worked in the S.W. of the country.

Throughout this period in Great Britain the distribution of the land masses was much as it had been in the



Britain in Coal Measure Times (After Willis).

Lower Carboniferous age but towards the close desert conditions began to appear in the V. and gradually extended S. and the period closed with considerable earth movement.

The coalfields of the Ruhr and Saar and of Silesia are also of the Upper Carboniferous age. Farther E. in the region of the Urals marine conditions prevailed at this time. This was due to a land mass stretching from Scandinavia to S.W. Russia which through out most of the Carboniferous period divided Europe into a quiet shallow sea to the E. and an area of earth movement and mountain building to the W. The highest beds the Stephanian are

found in S. Europe, Russia, Asia and the United States. The important coal deposits of Pennsylvania are of Westphalian age.

The fossils found in the Carboniferous limestone are those characteristic of clear water that is to say crinoids, corals, foraminifera and brachiopods (q.v.). Many of these formed important limestone deposits.

The Coal Measures are notable for the size attained by the fossil plants, some reaching a height of 100 ft. They were mostly ferns, tree ferns and the ancestors of our present horse tails and club mosses.

Of the economic products of the Carboniferous coal is of course the most important but ironstone deposits, oil shale and various clay deposits are of value. Fire clay generally underlies a coal seam and represents the muddy ooze in which the plants grew. Important petroleum deposits occur in the Upper Carboniferous of the U.S.A. The purer Carboniferous limestone is used for lime and bleaching powder and as a flux in iron working. The less pure is used for cement. Various sandstones are used for building.

**Carbon Monoxide** (carbonic oxide)  $\text{CO}$  is a colourless almost odourless gas lighter than air and inflammable. It has a boiling point of  $-190^\circ \text{C}$  and a melting point of  $-90^\circ \text{C}$ . The gas is produced by the incomplete combustion of carbonaceous fuels and it is present to an appreciable extent in various industrial fuels such as water gas, producer gas and coal gas (q.v.). It occurs naturally in some volcanic gases. The gas is also present to a considerable amount in the exhaust gas of internal combustion engines.

Carbon monoxide is extremely poisonous owing to its great affinity for the oxygen-carrying haemoglobin of the blood with which it combines to give carboxy haemoglobin thus inhibiting the respiratory processes with consequent rapid death. The pure gas has no uses but owing to its calorific value it is an important

constituent of the above-mentioned gaseous fuels

Carbon monoxide has the interesting property of combining directly with certain metals to form additional products known as *carbonyls*. The most important is nickel carbonyl, which is used industrially for the purification of nickel (*qv*)

Carbon Tetrachloride,  $\text{CCl}_4$ , is a colourless liquid having a characteristic odour and with boiling-point  $76^\circ \text{C}$  and melting-point  $-23^\circ \text{C}$ . It is manufactured by passing chlorine into hot carbon disulphide, the reaction being catalysed by iodine. Carbon tetrachloride is non-inflammable, and is in fact used as a fire extinguisher. It is also used to a considerable extent as a solvent. It is poisonous.

Carbonyl Chloride, or phosgene,  $\text{COCl}_2$ , is a colourless volatile liquid having a boiling-point of  $8^\circ \text{C}$  and a melting-point of  $-75^\circ \text{C}$ . It is formed by the direct union of carbon monoxide and chlorine on exposure to sunlight. The industrial method of manufacture is to pass a mixture of carbon monoxide (obtained from producer gas) and chlorine through charcoal, which acts as a catalyst.

Phosgene is utilised in the manufacture of certain dyestuffs, and also in other organic syntheses. In the World War it was used in large amounts as a poison gas.

Carbonyls (chem) are compounds formed by various metals, such as nickel, iron, cobalt, and molybdenum with carbon monoxide. The compounds are mostly liquids. See also CARBON MONOXIDE.

Carbuncle. (1) A name formerly given to almost any translucent red mineral, and especially to red garnets, for which it has been retained. It refers rather to a particular mode of cutting the stone, which produces a domed or convex surface.

(2) A hard, inflamed, painful swelling beneath the skin, resembling a large boil (*qv*), but often having several openings. If the contained matter is discharged, the carbuncle may heal

but usually it is necessary to remove the dead tissue within by an operation. Carbuncles may be several inches in diameter, and are most frequently developed on the nape of the neck. They are an indication that the general system is unhealthy, and it is essential measures should be taken to remedy this.

Carburettor (or Carburettor), a device whereby air is charged with a very finely divided hydrocarbon. It is used chiefly in motor-cars, petrol being the hydrocarbon. Carburettors differ widely in design, the aim being to furnish a combustible mixture of nearly constant richness whatever the speed of the engine.

The first part is a float chamber, supplied with petrol from a tank. The float closes the inflow by means of the needle valve when the petrol level is nearly up to the tip of the jet, which projects into the mixing chamber. Air also enters this mixing chamber through a choke tube, and another tube, closed by a throttle-valve, leads to the engine. Air is drawn in when the engine is turning over and carburetted with a fine spray of petrol issuing from the jet. Since the suction varies according to the speed of the engine, it is difficult to get the right proportions of air and petrol. This difficulty is met in four ways: (1) an auxiliary air supply, the main supply being set for slow running, (2) the jet is constant and the size of the air-tube is controlled by the throttle, (3) the petrol and air supply vary simultaneously, either automatically due to suction from the engine, or by the throttle lever, (4) the air-supply is constant, and there is an auxiliary jet for low speeds, the main jet being set for normal speeds.

Paraffin carburettors are constructed on the same principle, but the mixing chamber is heated at first by a lamp or by running the engine for a time and then exhaust, and then vices

enable crude oils and the whole range up to alcohol to be used as fuel

Aeroplane carburettors are often fed by pumps so that the plane can fly upside-down if necessary or at acute angles where a gravity feed would not function

**Carcassonne**, French town capital of department of Aude c 60 m S.E. of Toulouse Carcassonne is divided into the Ville Basse (modern) and the Cité (mainly mediæval) which are united by two bridges across the Aude R. The Cité is a remarkable example of early fortification the Ville Basse is the centre of an important wine district Manufactures include agricultural implements tanning and distilling Pop 34 000

**Cardamom**, *see* SPICES

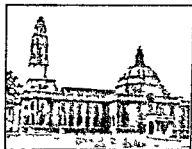
**Cardan**, **Girolamo** (1501-1576)

Italian scientist and astrologer Born at Pavia and educated at the university there he graduated in medicine at the University of Padua He became Professor of Medicine at Pavia in 1547 went to Scotland in 1561 was given a professorship at Bologna in 1562 and died 14 years later at Rome His private life was embittered by the criminal character of one and the execution of the other of his sons Towards the end of his life he became the victim of religious persecution

Cardan published a treatise on algebra in 1545 in which he included a formula for solving equations of the third degree and in his *de Subtilitate Rerum* (1531) he showed the wide extent of his learning and his scientific outlook, in many ways far in advance of his time The two autobiographical works he wrote in his closing years *de Vita Propria* and *de Libris Propriis* show him as a man of exceptional intelligence and attractive personality

**Cardiff**, seaport and leading industrial centre of S Wales situated at the mouth of the Taff R. county town of Glamorganshire Cardiff's prosperity arises from the export of coal and iron of which there are enormous deposits in the neighbouring inland districts

The industries include smelting ship building iron and steel works brewing and tin plate making The docks are among the largest in the British Isles the most important are the Bute Roath Berry and Penarth docks The imports while very much



Cardiff City Hall

less than the exports are considerable iron ore pitprops grain live cattle and provisions are the chief

Its castle dates from 1090 modern buildings include the University College of S Wales and Monmouthshire the Welsh National Museum and the City Hall Llandaff Cathedral lies  $\frac{1}{2}$  m N.W.

Excavations have proved that Cardiff was occupied by the Romans if not definitely founded by them its excellent position has always given it some importance but only in the last 100 years has it grown towards its present dimensions Its pop in 1931 was c 3 648

**Cardigan** (1) a Welsh county bounded S by Iemlroke and Carmarthen E by Brecknock Radnor and Montgomery N by Merioneth and W by Cardigan Bay It is generally mountainous except for the coastal strip the chief peaks being Plinlimmon (463 ft) and Tregaron Mountain (1778 ft.) The rocks consist mainly of folded shale and slate and produce valuable mineral of which lead and copper are predominant The main river is the Teifi which rises in Tre-

## Cardinal

garon and flows W to Ca  
salmon are plentiful Agric  
important, and yields wheat  
barley, potatoes, etc Shee  
cattle are raised in large numbe  
the native ponies command good  
The chief towns are Ca  
Aberystwyth, and Lampeter  
55,164, area, 690 sq m

(2) County town of Cardiga  
Wales, is situated on the W coa  
above the mouth of the R  
Cardigan is an important market  
and manufactures bricks and  
its shipping is unimportant Pop

**Cardinal**, a name given to v  
kinds of scarlet birds, but u  
assigned to a N American Bu  
(*q v*), a popular cage-bird also  
the Virginian Nightingale

**Cardinals**, name given to the  
mediate advisers of the Pope by  
they are chosen, together they  
up the "Sacred College," and  
committees for the administrati  
various Church affairs, they ad  
ter the Church during a vacancy i  
Pontificate, and elect the new I  
The full number of the college i  
but there are usually several vacan  
Some of the Cardinals reside per  
ently in Rome, others are bisho  
the more important sees in vai  
countries Their badge of office is  
Red Hat, with which they are inve  
on appointment

**Card Index**, a system of recor  
series of names, addresses, bo  
stocks, shares, etc., by allotting  
small card of uniform size to each,  
arranging the whole in alphabet  
order in a drawer, case, or other  
ceptacle By this system a list  
be continually added to, subtrac  
from, altered, kept up-to-date, a  
readily referred to

The cards may be loose, punch  
and mounted on a metal runner,  
mounted on a hinged panel, whi  
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cluded Gabriele d'Annunzio and Mathilde Serao Carducci won the Nobel prize for literature in 1906

**Carew Thomas** (c 1498-c 1640) English poet intimately connected with the Court of Charles I His poems show the influence of Jonson and Donne (q.v.) and are at their best a brilliant crystallisation of sensuous emotion The greatest are *The Rapture* and *The Second Rapture*

**Carey Henry** (c 1690-1743) English song writer author of *Sally in our Alley* and possibly of the National Anthem

**Carey Henry Charles** (1893-1879) American economist and publisher In his *Principles of Social Science* (1859) he analyses the origin of land values rejects Malthusianism and asserts the beneficent character of economic laws

**Cana**, an ancient province of Asia Minor on the W coast bounded by Ionia and Lydia on the N by Lycia on the E and by the Aegean on the S and W Cana was conquered by the Persians and later by the Romans

**Caribbean Sea**, the is bounded on the W by Central America S by Panama and the N of S America E by the Windward and Leeward Islands and N by the Greater Antilles It is connected through the Yucatan Channel with the Gulf of Mexico This sea was formed by a subsidence and there is a considerable submarine bank between Jamaica and Honduras

**Caribon**, see REINDEER

**Caribs** Indian tribes of a warlike nature who originally inhabited Venezuela part of Colombia parts of Brazil and the adjacent islands They were first discovered by Columbus in the Lesser Antilles and were decimated by the Spanish conquests They were taller than most Indians round headed often cannibalistic and excellent navigators with their sail-canoes The word Carib means stranger a name applied by the original tribesman to the new comers Their descendants now live in Nicaragua

**Caricature** a pictorial satire originally a portrait in which some feature was absurdly exaggerated Caricature is essentially a popular form of art of great political value In its modern form caricature appears to have originated in Italy c the 16th cent and to have flourished particularly in Bologna Deliberate pictorial attack on the appearance of political leaders was introduced in England about the middle of the 18th cent. by George Townsend though symbolic representations of people and of institutions such as the Papacy had existed for over a century previously Hogarth (1697-1764) was the great originator of satire directed against social custom and foible Towards the end of the 18th cent caricature was greatly encouraged by the increasing number of magazines and the cheapness of engraving and lithograph printing Fashion medicine but above all the private lives and characteristics of politicians were portrayed with increasing brutality and coarseness Powlandson (1706-187) and Gillray (1757-1815) carried this fashion to its extreme with their brilliant gifts of draughtsmanship With the early years of the 19th cent caricature as exemplified in the work of George Cruikshank (1792-1881) John Doyle (HB) and Robert Seymour became less crude and more devoted to direct humour while in 1840 the new tradition of quiet impersonal satire was expressed in the pages of *Punch*

The Victorian tradition which had become steadily more genteel and meaningless as the century progressed was broken in 1894 by the appearance of Aubrey Beardsley and Max Beerbohm in *The Yellow Book* The former introduced crisper line and more acid approach while the latter exercised his unique genius notably in real caricature (as opposed to mild Victorian portraiture) but also in the presentation of satirical situations which added point to his penetrating draughtsmanship These two together may be said to have provided

all the ingredients for the daily newspaper caricature which is so typical of 20th-cent British work, and which was given point and acerbity by the necessities of the World War. Strube and Low, with their gifts of brilliant characterisation, their decisive styles, and genius for witty situations, now lead the English school, the caricature of the weeklies remaining consistently realistic and more in the nature of illustration to verbal jokes than true caricature.

**France** French caricature has always been marked by an extreme individuality, and its 19th-cent style was fixed in a purely French mode by Daumier. With the establishment of numerous comic papers, culminating in *Le Rire* (1894), it tended, though marked by brilliant artistic qualities, to concentrate on the lighter aspect of caricature. Since the War, German influence has to a certain extent weakened the purely French idiom, and added a new acidity and modernism of style. *Fantasia* contains typical examples of modern French work.

**Germany** German caricature has, since its early days, had two aspects—the homely, typified by caricature of bourgeois life, and the mordant. Of these the latter has gained almost complete ascendancy since the War, and has been emphasised by extreme exaggeration of style and line in the modern manner. Personal caricature, especially, attained an extraordinary cruelty and penetration. *Simphersimus*, *Jugend*, and *Klatteradatsch* are the chief vehicles of German caricature to-day.

**U.S.A.** American caricature began in the early 19th cent. under the direct influence of the English artist, Gillray, first developing an individual bent during the Civil War with the work of Nast (1840-92). While remaining in close connection with the British school for many years, the Americans gradually began to develop in the 20th cent. a new style based on the mental quickness necessary for

jumping several stages in logical deduction. While political caricature continued in a conservative, though sometimes dramatic, vein, humorous caricature set out on an increasingly picaresque path, culminating in the brilliant satirical work of Peter Arno and others. The chief American humorous journals are *Judge*, *Life*, *New Yorker*, and the recent *American* and *Ballyhoo*. A Pulitzer prize is awarded annually for the most effective cartoon.

**Carillon**, a set of bells by which melody may be played either mechanically or by hand. See also BELL.

**Carinthia**, Austrian province on the borders of Italy and Yugoslavia, bounded on the N by Salzburg. The district is mountainous, the highest peaks being Gross Glockner (12,400 ft), Ankogel (11,000 ft), and Hoch-nar (10,600 ft). The Drave, which flows W-E, is the main river, and there are a number of Alpine lakes. Carinthia is rich in minerals, producing lead, coal, and iron, machinery and steel goods are manufactured. Agriculture includes rye, wheat, oats, cattle, sheep, and horses. Capital, Klagenfurt. Area, 3610 sq. m.; pop. 380,000.

**Carisbrooke**, a town in the Isle of Wight, England, c. 1 m. from Newport, is best known for its castle, where Charles I. was imprisoned. There are two wells of exceptional depth in the castle. In the valley there are a few Roman remains. Pop. 4500.

**Carisbrooke**, Alexander Albert Mountbatten, 1st Marquess of (b. 1886), eldest son of Princess Beatrice and grandson of Queen Victoria. His father was Prince Henry Maurice of Battenberg. He joined the Navy in 1902, and took a commission in the Grenadier Guards in 1911, serving with them during the World War. He was created Marquess of Carisbrooke in 1917, when he abandoned the title of Prince Alexander of Battenberg. His wife is a daughter of the Earl of Londesborough.

**Carlie**, Richard (1790-1813), Eng-

lish Radical and free-thinker published and sold suppressed books notably the works of Hume in 1818 and produced a periodical, *The Republican*. Carlisle spent over 9 years of his life in prison.

Carlisle Wilson (b 1847) founder of the Church Army 1882. Prebendary of St Paul's Cathedral since 1906.

Carlisle an English cathedral city and the county town of Cumberland standing some 7 m S.E. of Solway Firth. It is a very busy railway centre all the important N.W. lines passing through it. Carlisle has been the seat of a bishop for many centuries and St Cuthbert is believed to have founded a convent there.



[Courtesy L.M.S.A.]

Carlisle: Law Courts.

The cathedral dates from the early 13th century. Carlisle has considerable manufactures including iron textiles and biscuits. It was a Roman settlement then called *Luguvallium* and lay a short distance S. of Hadrian's Wall. Pop. 57,107.

Carlisle Earls of JAMES HAY 1st Earl (d 1636) was a Scottish favourite of James I. He was created Lord Hay in 1615 and became Earl of Carlisle in 1629. Carlisle was envoy to France and Spain negotiating for the Huguenots and for Prince Charles's marriage to Henrietta Maria in 1624. He was keenly interested in the W. Indies and the colonies. His second wife Lucy celebrated by Caroline

poets worked for both parties during the Civil War. He left no heir and the title became extinct but in 1661 it was revived for CHARLES HOWARD (1679-1693) a Protestant who had fought for Cromwell at Worcester later serving in Cromwell's Council of State. Army and Parliament. He then worked for the Restoration was Ambassador to Russia in 1663 and Governor of Jamaica 1677-81. The title has continued in his line FREDERICK HOWARD (1748-1837) 5th Earl was a member of Lord North's commission which attempted to reconcile the American colonies in 1778. He was successful as Viceroy of Ireland from 1780 to 1789 in founding a national bank. He was a guardian of Byron the poet who satirized him in *English Bards* (1809).

GEORGE HOWARD (1773-1848) 6th Earl served on the Indian board in 1800 and held office under Canning and Grey. GEORGE WILLIAM HOWARD (1801-1864) 7th Earl supported Grey in the Parliamentary reform movement (1831). Melbourne appointed him Chief Secretary for Ireland (1833-1841). He joined the Cabinet, and was Lord Lieutenant of Ireland (1835-8 and 1859-64). He was an accomplished scholar and writer and interested in social reform.

Carlists, supporters of the claims of Don Carlos the Elder (brother of Ferdinand VII) (1834-1855) and the Younger (nephew of the Elder) (1848-1909) to the Spanish throne. King Ferdinand VII had altered the law of succession to secure the crown for his daughter Isabella. Risings of Carlists occurred in 1846-8 but were defeated after some successes. The war broke out again in Catalonia in 1873. The Carlists obtained the greater part of Navarre, Catalonia, Lower Aragon and the Basque provinces. They were defeated in 1875.

Carlos I (1863-1908) King of Portugal succeeded his father Louis I in 1889. He effected conciliation with Great Britain over the S. African dispute. His appointment of Franco



as dictator in 1907 led to his resignation, and that of his heir, Louis, in Lisbon. He was succeeded by Manoel II, his second son.

**Carlow:** (1) Small Irish county in the S.E. immediately N. of Wexford and Kilkenny. Has considerable agricultural productions, including dairy produce, corn, flour, sheep, cattle, and poultry are raised. The county is mainly flat, but in the S.E. are Knockree Mountain (1746 ft.) and Mount Leinster (2610 ft.). The Barrow and the Slaney are the only rivers of note. Area, 316 sq. m., pop. 34,176. (2) County town of above. It lies on the R. Barrow. Dairy produce and milling are the chief occupations. Pop. 7000.

**Carlsbad (Karlový Vary)** a city in Czechoslovakia, some 75 m. W. of Prague. It is famed for its hot springs, which are of great medicinal value; the Sprudel is the principal. The town is very picturesque, being surrounded by mountains, and is a favourite resort. It was built by the emperor Charles IV, and derived its name from him. It exports considerable quantities of its waters and chemical salts, and has a large stoneware and porcelain industry. Pop. 15,000.

**Carlstadt**, name given to Andreas Rudolf Bodenstein (1460-1511), a German clergyman and supporter of the reformed religion. He attacked the doctrine of justification by works and defended Luther's thesis against opponents. His later views, denying the necessity for a clergy, brought him into conflict with Luther. He recanted after the Peasants' War (q.v.).

**Carlton Club**, the leading Conservative Club in London, founded in 1832 by the Duke of Wellington and situated in Pall Mall. The historic split in the Conservative Party took place at a meeting there in 1922, when the larger part of those present, all leading members of the party, decided to withdraw from the Coalition, and support Bonar Law (q.v.), while the minority, led by Austen Chamberlain, decided to continue to support the Coalition under Mr. Lloyd George.

This resulted in the fall of the Coalition, and the formation of a Government by Bonar Law.

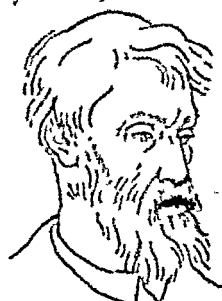
**Carlyle, Thomas** (1795-1881), Scottish author. His first book, a *Life of Schiller*, appeared in 1825. In 1826 he married Miss Jane Welsh, and until 1833 was engaged in translating and writing literary and critical articles. His first important work, *Sartor Resartus*, appeared in 1833-4. He then moved to Chelsea, where he remained until his death. His *French Revolution* was published in 1837. His other works include *Chartism* (1839), *Past and Present* (1843), *Cromwell* (1845), and *Frederick the Great* (1858-65). Carlyle's explosive style

was well suited to his vigorous condemnation of cant and hypocrisy, and his deep love of Germany and all things German considerably influenced his work. If he did not offer remedies for the social malady, which he diagnosed at least he was successful in discovering and drawing attention to them.

**Carmagnole**, the name of a song and dance in vogue in Paris during the French Revolution.

**Carman, William Bliss** (1861-1929), Canadian journalist and poet, worked on the staffs of the *New York Independent* and *Atlantic Monthly*, but is better known for his sensuous nature-loving verse. This was published in many volumes, which include *Low Tide on the Grand Pré* (1893), *Songs from Vagabondia* (1894, 1896, 1901), *Pipes of Pan* (1903-5), and *Later Poems* (1921).

**Carmarthen:** (1) the largest county of S. Wales, bounded on the S. by Carmarthen Bay, N. by Cardigan E.



Thomas Carlyle

by Brecon and Glamorgan and W 1 y Pembrokeshire. The surface is largely mountainous with the Black Mountains on the L (Carmarthen Van 213' ft) and in the N.E. Mynyddi Mallam rising to 1430 ft. The rivers include the Towy Gwith Sawdde Teifi Loughor and Gwendraeth. Carmarthen is largely agricultural and dairy farming cattle and sheep raising and grain growing are carried on. In the S.E. which covers part of the great mineral district of S. Wales there is considerable industrial activity. Carmarthen was ravaged by the Danes and conquered by the Normans. It joined in Owen Glendower's revolt but is not otherwise historically notable. Area 919 sq. m. pop. 179,063. (°) County town of above on the R. Towy c. 18 m. N.W. of Swansea. Its manufactures include tanning woollens slates but it is most important as a market for local farm produce. Carmarthen is of very early foundation and believed to be on the site of the Roman Maridunum. Its name is said to be derived from Merlin. Pop. 10,300.

**Carmel mountain** (1740 ft) in Palestine forming a headland S. of the Bay of Acre. The mountain is continued in a high ridge running S.E. to join the Samarian mountains c. 20 m. distant. Mount Carmel is referred to in the Bible as the site of incidents in the lives of Elijah and Elisha. A monastery of the Carmelite Order (qv) has been several times destroyed and rebuilt.

**Carmelites** a religious Order founded in 1156 on Mount Carmel by a Crusader Berthold though it claims descent from the Old Testament prophets of the school of Elijah. They left Palestine and came to Europe in 1238 owing to the Mohammedan danger and became a mendicant Order known in England as White Friars because of their white cloak. An Order of Carmelite nuns was founded 145. St Teresa (qv) and St John of the Cross were famous members of the Order which is still represented in England by communities of both sexes.

**Carmen Sylva**, pen name of Elizabeth Queen of Rumania (1843-1916). She is best known for *Les Femmes d'Albanie* (188 ) she wrote in several languages and was greatly interested in Rumanian history and literature.

**Carminatives**, drugs which relieve flatulence in the alimentary canal by stimulating the movements of the stomach and intestines to expel the gases. There are many such drugs including anise caraway camphor peppermint valerian etc. but any aromatic such as ginger or nutmeg is a mild carminative.

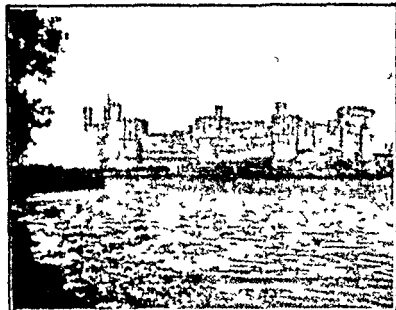
**Carmine** red colouring matter or paint made by crushing cochineal beetles and boiling them in water. When the sediment has settled cream of tartar or alum is added and this precipitates the carmine. It is used as a colour by artists in dyeing scarlet material and for colouring toothpastes.

**Carmona, Antonio Oscar de Fragosa** (b. 1859) a Portuguese politician and general who became dictator in 1906. He was supported by the Army and by the Royalists and succeeded in suppressing revolts that broke out at Oporto and Lisbon in 1907. He was elected President of Portugal in 1908 for a period of 4 years but again acted as military dictator exercising a complete censorship over all news. On May 28 1933 he promulgated a new constitution allowing for a presidential election on a 7 year term and for a national chamber of 90 deputies elected for 4 years. This constitution was adopted by the vote of the people in March 1933.

**Carnac** French village in the Department of Morbihan some 12 m. S.E. of Lorient. It is celebrated for a number of stone monuments in the neighbourhood somewhat reminiscent of Stonehenge. The remains of a Gallo-Roman town are near by.

**Carnarvon** county town of Carnarvonshire situated in N.W. Wales at the S.W. end of the Menai Straits. Carnarvon is important historically and as a tourist centre. Its castle dates from the 13th cent. and is a

valuable example of mediæval fortification. Formerly it was the place of



(Courtesy L. M. S. R.)

Carnarvon Castle

investiture of the Princes of Wales and the custom was revived in 1911. Industries, which are not important, include shipbuilding and tanning, slate is exported. Pop 8469.

**Carnarvonshire**, a NW county of Wales, 570 sq m in extent, bounded on the N and W by the Irish Sea and Anglesey, on the S by Merioneth, and E by Denbigh. It is separated from Anglesey by the Menai Straits, and resolves itself into the Lleyn peninsula on the SW, which forms the N boundary of Cardigan Bay. The county is mountainous, and is famous for its scenery, the highest peak is Snowdon (3560 ft), and others of note are Carnedd Llewellyn (3484 ft), Carnedd Dafydd (3426 ft) and Y Glyder Fawr (3279 ft). The main river is the Conway, which flows mainly along the borders of Carnarvonshire and Denbigh. Carnarvonshire is principally an agricultural district noted especially for its sheep and cattle, a good deal of barley is grown in the Lleyn peninsula, and dairy farming is carried on in some places. In the N there is a considerable slate and granite industry. Carnarvonshire came under the English crown in the 13th cent under Edward I, and saw Owen Glendower's revolt in the 15th cent. There are remains both of the ancient Britons and Romans. The

chief towns include Carnarvon, Bangor, Pwllheli, and Conway. Pop 120,800.

**Carnatic**, a territory of the Madras Presidency, British India, situated between the E Ghats and the E coast. A keen struggle for its possession took place between the British and the French in the 18th century. In 1801 the district was formally ceded to Britain.

**Carnation**, a garden flower of the family Caryophyllaceæ, found wild in S Europe. It can be grown under glass to flower practically the whole year round. Border Carnations are still cultivated to some extent, but are largely superseded by the Perpetual Flowering varieties. Propagation is by cuttings of side shoots 3 or 4 in long, and with a heel and these are best taken from November to February.

**Carnegie**, Andrew (1837-1919), American industrial magnate and philanthropist, was born in Dunfermline, Scotland, of humble parentage. In 1848, the family emigrated to America, where Carnegie was employed on the Pennsylvania Rly. Here, slowly at first, but later by leaps and bounds, he began to acquire that fortune which, at his retirement, amounted to a capital of £100,000,000. He became the owner of railways, oil-wells, iron-works, and steamships, and his many companies were incorporated in 1901 as the U.S. Steel Corporation.

After his retirement (1901), living in Scotland and New York, Carnegie distributed his wealth among libraries, universities, schools, and numerous other institutions. Four great Trusts in the United Kingdom and six in the United States have been set up to administer the enormous



Andrew Carnegie

sums he left for educational and other purposes

**Carnegie Trusts** a series of charitable foundations in the United Kingdom and the USA instituted by the multi-millionaire Andrew Carnegie who regarded the possession of wealth as making him trustee and agent for his poor brethren. The four Carnegie Trusts in the United Kingdom are the Trust for the Universities of Scotland (£2 000 000) the Dunfermline Trust (£750 000) the Hero Fund Trust and the United Kingdom Trust (£2 000 000). Grants are made principally for education libraries drama music welfare centres playing fields and rural development. There are six Carnegie institutions in the USA the Institute of Pittsburgh the Institution of Washington the Hero Fund Commission (Pittsburgh) the Foundation for the Advancement of Teaching (New York) the Endowment for International Peace and the Carnegie Corporation of New York with a total capital of nearly \$200 million.

**Carnelian** a semi-precious stone which is found in India and other localities. It consists of a mixture of quartz with amorphous silica and is coloured red by minute traces of iron oxide. See **GEM**.

**Carnera, Primo** (b 1907) Italian boxer became the world's heavyweight champion by defeating Sharkey the

ex-champion of France before this he had been carpenter mason day labourer and circus wrestler. He is remarkable for size and strength being about 6 ft 10 in in height weighing over 19 st and one of the strongest athletes in the world.

**Carnic Alps** see **ALPS**.

**Carniola**, formerly an Austrian duchy around the Laibach district now merged in Yugoslavia.

**Carnival**, a period of revelry and merry making observed in Roman Catholic countries especially Italy during the days immediately preceding Lent. The carnival celebrations which probably originated from the ancient Roman festival of the *Saturalia* were in former days often characterised by the wildest licence. In France the revels take place chiefly on Shrove Tuesday (*ardi gras*). The word is now often applied to any day devoted to merry making usually in aid of charity.

**Carnivora**, an order of placental mammals (*q.v.*) with never fewer than four toes which are tipped with claws. The first toe when present is the smallest of the five and is not opposable. The incisors canines and cheek teeth are sharply distinguished by size and structure there being typically six incisors above and below the inner ones being smaller than the outer. The brain is well developed.

Structurally the Carnivora come nearest to the Insectivora (*q.v.*) but are more highly organised especially in brain development and usually differ from them in the relative size of the teeth. They are not all exclusively flesh-eaters and the cheek teeth vary greatly according to the food but usually one above and one below known as the carnassials have blade-like cusp for shearing flesh.

The Carnivora are divided into two sub-orders (1) The *Aeluroides* in which the bone at the back of the nose is very long and the ear bone is divided into two (2) the *Arctoidea* in which the bone of the nose is short



Primo Carnera.

previous holder in 1933. He was discovered in 1928 by Paul Journee and

and the ear-bone is undivided. This sub-order includes the dogs, bears, weasels, and raccoons, in which the front feet are never paddle-like, and the seals, sea-lions, and walruses, with all the feet converted into paddles for swimming.

Land Carnivora are found native all over the world, except in the Australian region and the Antarctic Continent. The seals occur in all seas except the Indian Ocean.

Of the families of the Carnivora the cats, dogs, and weasels are found in Europe, Asia, America, and Africa, but not in Madagascar. The civets, mongooses, and hyenas are confined to the old world, the first two occurring in Madagascar. The raccoons are mainly American, with two related forms in Asia. The bears are absent from Africa, except Morocco.

The principal fossil Carnivora are the sabre-toothed tiger (*q v*), representing the cats, some hyenas from Pliocene deposits, and dogs which can be traced to the early Tertiary deposits where they blend with the bears and probably the civets. But in the Lower Eocene there exists a still more primitive group of Carnivora, called *Creodonta*, which in the structure of their teeth and small brains showed kinship with the Insectivora.

**Carnot, Lazare Nicolas** (1753-1823), French general. As engineer in the Army, he joined the Montalembert school of fortification. He was elected Republican deputy in 1791, and reorganised defence, assisting Jourdan at Wattignies. He was a member of the Committee of Public Safety in 1793, and joined the Five Directors in 1795 to control the War Department, then served as President. Becoming Minister of War in 1801, he was commissioned by Napoleon to write on fortification in 1809. He returned to the Army in 1814, defending Antwerp. Exiled after Waterloo, he died at Magdeburg. The Carnot wall (*Defense de Places Fortes*, 1810) is important in modern fortification.

**Carnot, Marie Sadi** (1837-1894), grandson of L. N. Carnot, and 4th President of the 3rd French republic, was educated as a civil engineer, and served in the Defence Department. He was elected to the Assembly in 1871, held Cabinet office in charge of public works and finance, and, following Grévy's downfall, was elected President of the Republic in 1887. He increased the republic's prestige in face of General Boulanger's attacks. He was assassinated by an anarchist at Lyons.

**Carob Tree**, sometimes called locust tree, or St John's bread, from a tradition that the pulpy matter surrounding its seeds supplied food to St John the Baptist in the wilderness. It belongs to the pea and bean family.

**Carol**, specifically a song or hymn of joy sung in celebration of the Nativity at Christmas, but the term is also used with a wider application. Many English carols are as old as the 15th cent., and the first collection was printed in 1521 by Wynkyn de Worde.

**Carol I** (1839-1914), King of Rumania, served in the Prussian Army, Prince of Rumania (under Turkish suzerainty) 1866, fought for Russia in the Russo-Turkish War, 1877-88, gained Rumanian independence, and was crowned King in 1881. He died at the outbreak of the World War.

**Carol II** (b 1893), King of Rumania, served with distinction in the World War. In 1918 he made a morganatic marriage with Mme Lambino, which was dissolved. In 1921 he married Princess Helen of Greece, but eloped with Mme Magda Lupescu in 1925, renouncing his right of succession, an act which was ratified in the next year by Parliament. On the death of King Ferdinand in 1927 Carol's son, Prince Michael, became king under the regency of Queen Marie, and in the next year Princess Helen divorced the ex-Crown Prince. He returned to Rumania, and was proclaimed king in the place of his son, in 1930.

**Carolina, N.**, see NORTH CAROLINA.

**Carolina, S** see SOUTH CAROLINA  
**Caroline** (1768-1821) wife of George IV King of Great Britain. She married George then Prince of Wales in 1795 but they separated in the following year and after the report of a Commission of Enquiry the princess left to live in Italy in 1814. She returned in 1820 to claim her royal rights on George IV's accession but a Bill for the dissolution of her marriage was introduced into the House of Lords and passed but then abandoned. Caroline was debarred from entering Westminster Abbey on George's coronation in 1817 and died shortly afterwards.

**Caroline Islands** a Pacific archipelago due N of the Solomon Islands since the World War a Japanese mandated territory. Many are small coral islets but four viz Iouape, Kusaie, Truk and Yap are inhabited. The total land area is 310 sq m. Vegetation is rich and local products include copra, pearl and *bêche-de-mer*. The islands were purchased from Spain by Germany in 1899. Pop. 38,000.

**Caroline Wilhelmina** (1683-1737) consort of George II King of Great Britain and Ireland. Married the latter when prince of Hanover (1705) and accompanied him and his father (George I) to England (1714). Crowned queen (1727) and acted as regent during George II's absence in Germany. Caroline was a patron of literature and as queen a supporter of Walpole.

**Carolingian Cycle** the term applied to those Franco-Teutonic or French romances dealing with the legendary history of Charlemagne and his paladins Roland, Oliver, Turpin etc. and the traitor Ganelon. Actually these amount to the grouping together of and of accretions to the early episodic *chansons de geste* concerning the exploits of Charlemagne.

**Carolingians**, the family of Charlemagne from whom it took its name. Arnulf created Bishop of Metz in 613 and Pippin I both Austrasian nobles and counsellors of Clotaire II of Neustria were the first members of

note. Pippin became Mayor of the Palace under Clotaire's son Dagobert King of Austrasia. Pippin's grandson Pippin II gained a victory for the Austrasians over the Neustrians in 687 and governed the Frankish kingdom till his death in 714. Pippin's natural son Charles Martel seized power from his rivals governing till 741 and his son Pippin III took the title of King in 751. His son was Charlemagne (749-814). In France the Carolingians were succeeded by the Capets in 987. The German branch ended with Louis IV (d. 911) and the Italian branch with Charles (deposed 887).

**Carolus Duran** (1839-1917) French painter and teacher of art. His real name was Charles Auguste Émile Durand. He achieved his greatest success as a portrait painter but he did not confine himself to this branch of work. He was head of an art-school in Paris where many well-known modern painters were trained. Examples of his work hang in the Luxembourg.

**Carotene** (carotin)  $C_{40}H_{56}$  is a hydrocarbon that is present in a large number of plants in the rôle of a red pigment. It is present to a large extent in carrots to which it gives the red colour and whence it derives its name.

Carotene has come to be of great theoretical and practical interest in recent years owing to its great biological importance as the precursor of Vitamin A. It has been found that if animals are fed on carotene this possesses the properties of Vitamin A and on the basis of experimental evidence it has been concluded that the carotene is transformed to Vitamin A in the animal body. Industrially carotene is used as a pigment principally for butter and cheese.

**Carotid Arteries** the two large arteries which pass along the neck, one on each side of the windpipe and supply the head with blood. In the lower part of their course they are called common carotids and in man that on the left arises directly from the aorta

(qv), but that on the right arises from the innominate artery, which at that point becomes the subclavian artery going to the arm. Each common carotid divides in the neck into an external carotid supplying the scalp and face, and an internal carotid, which passes through a hole in the skull and supplies the eye and brain.

**Carp**, a freshwater fish of Europe and Asia, the common species having been introduced into England. Here it attains a length of about 2 ft and weighs up to 20 lb, but continental specimens are larger. The leather carp is an aquarium variety in which the scales are absent or reduced in number, in the latter case being enlarged and arranged in rows on the sides and back. Other fancied varieties, related to the true carp, but having no barbels, are popularly called goldfish, of which many grotesque forms have been bred artificially, some having the fins, especially the tail fin, which may be duplicated, greatly enlarged, while in others, the telescope fish, the eyes may be prominent and movable.

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**Carpathian Mountains**, a great mountain system of S E Europe, over 800 m. in length, N. of the Alps, and

separated by the Hungarian and Walachian plains in the Danube valley. They form the watershed between the Black Sea and the Baltic, rivers include the Vistula, Dniester, and Tisa, the principal ranges are the White Mountains, Central and Little Carpathians, Transylvanian Alps, and Beskids, the highest peak is Gerlsdorfer (8737 ft). Minerals include coal, copper, lead, silver, and iron. The lower slopes are well wooded, and the surrounding districts fertile.

**Carpel** (bot.), the modified leaf which bears ovules on its margins, and ripens to form a fruit.

**Carpentaria**, Gulf of, large gulf on the N coast of Australia, situated between Cape York Peninsula and Arnhem Land. It contains several islands, including Wellesley Island, Groote Island, Vanderlin Island, and Bentinck Island, and receives several rivers, the Albert, Roper, Mitchell, MacArthur, Gilbert, etc.

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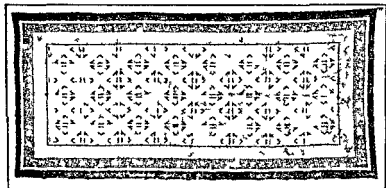
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**Carpenter Bee**, a large blackish solitary bee, of which there are many different kinds, found mostly in the

tropics The families are reared in deep burrows which the bees by means of their strong jaws dig in solid wood

**Carpentier Georges** (b 1894) French boxer He began boxing at the age of 14 under the management of François Descamps and won the Championship of France at every weight He twice knocked out Bombardier Wells in 1917 for the Heavyweight Championship of Europe beat Battling Levin sky in 1920 for the Light heavyweight Championship of the World but was knocked out in 4 rounds by Jack Dempsey in a contest for the World's Heavyweight Championship 1921

are knotted singly on the warp thread in Ghordes or Turkish they come in pairs between two warp threads The quality of a carpet is largely determined by its closeness of texture The number of knots per sq in varies from c 15 to 400 or even more the average hand made carpet having about 40 The fine colouring of an Oriental carpet is often said to be due to the exclusive use of vegetable dyes but aniline and alizarine (qv) are now much used in the East and the colours are mellowed by age sometimes by faking The floor-coverings known vaguely as Persian rugs are made throughout



Chinese carpet 17th c. Rare geometric design in two designs a pair of 13 ft 6 in.

#### Carpentry *see* WOODWORKING

**Carpet** a thick heavy woven fabric for covering floors A small carpet is called a rug Carpets appear to have originated in the East though owing to their perishable nature few existing specimens can be dated before the 16th cent Materials include wool worsted silk cotton jute and hemp Hand made carpets are either pile in which extra threads are introduced to form the pile or tapestry woven with the weft threads carried over and under the warp-threads as in tapestry (qv) Examples of the latter are kelim rugs and Aubusson carpets Most Oriental carpets and rugs are pile

In Sehna or Persian carpets the tufts

are an area stretching from N India to Greece where a flourishing carpet industry has arisen since 19 Many rugs are made by the nomadic tribes of Persia and Mesopotamia

The religion of the Mohammedan carpet weavers confines them to conventionalised patterns though some famous 16th and 17th-cent carpets have naturalistic representations of hunting scenes vases and flowers Some of the better known varieties are Kurdistan Hamadan Shiraz Tabriz Feraghan Kashan Khorasan and Kirman In India the designs have remained more natural Few carpets were made in the 16th and 17th cents In the late 19th cent jail produced



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**Carpenter Bee**, a large blackish solitary bee, of which there are many different kinds, found mostly in the

various freshwater fishes adhering by means of two suckers on its underside and sucking their blood

**Carracci** (pron KARAH CHE) Ludovico (c 1555-1619) Italian painter with his nephews Agostino (c 157-160) and Annibale Carracci (c 1560-1609) founded the Bolognese or Eclectic School of Painting. He studied under Tintoretto and with his two nephews obtained considerable renown for their school in Bologna, where he remained for the rest of his life. Agostino and Annibale went to Rome in 1600 the latter decorated the Farnese palace. Agostino proceeded to Parma where he painted frescoes including *The Marriage of Peleus and Thetis*. The work of all three was good technically and has been much admired but they had little of the artistic greatness of earlier

Italian masters. Several specimens of all of the Carracci work hang in the National Gallery London.

**Carrageen** (hot) also called Irish moss and edible seaweed

**Carranza, Venustiano** (1859-

1910) Mexican President 1917-20. Carranza was a Liberal with Socialist leanings. He supported Madero's revolution against President Diaz in 1910 and became governor of Coahuila. After the assassination of Madero in 1913 Carranza became leader of the revolutionary movement against Huerta and after driving him from the country defeated the military junta under Villa. In 1917 he called together a Constituent Assembly adopted a new constitution for Mexico and was elected President. He passed laws for the protection of labour and for the nationalisation of lands containing oil and coal and fought against the domination of Mexico by United States capitalism. In 1910 Obregón and González both of them military leaders led a revolt against Carranza

who was defeated captured and murdered.

**Carrara**, town in the W of Italy a few miles inland from Spezia in the Gulf of Genoa. Carrara is famous for its marble which has been quarried since Roman times and is of the finest quality about 500 000 tons are exported annually. The 17th-cent cathedral is interesting. Pop 23 000.

**Carrel Alexis** (b 1873) a French surgeon emigrated to America in 1905 and there achieved remarkable success in transplanting organs from one animal to another and in maintaining apparent life in organs even the heart when separated from the body as a whole. He was awarded the Nobel prize (Medicine) in 1912.

**Carrhae**, historic Mesopotamian city site of the great defeat of the Romans by the Parthians in 53 B.C. The Roman General Crassus was killed and only a remnant of the Roman army escaped.

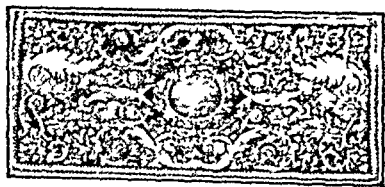
**Carriage** a vehicle drawn by a horse or horses and having accommodation for passengers. It developed from the primitive wagon or cart and is related to the ancient chariot. When the Roman chariot died out in the Middle Ages a heavy four-wheeled wagon was commonly used for the carriage of goods but passenger traffic was almost entirely upon horseback. Elizabethan times saw the development of a horse-drawn litter covered with a canopy and with the gradual improvement of city streets and country roads this form of vehicle was lightly sprung upon leather braces or steel springs evolving into the 18th-cent coach. The need for fast mail-coaches brought a rapid improvement in design which reached its zenith in the first half of the 19th cent. Thereafter the coach gave place in turn to the brougham, the dog-cart, the gig, the hansom and other light forms of carriage for 2 or 4 passengers.

Within the limits of this application of it, the term is also used for a railway coach and for the part of a motor car occupied by passengers.



Carrageen

carpets from Lahore compared favourably with the best productions of Persia, but the general quality of modern S Indian carpets is very poor. Turkish carpets are generally coarser than Persian. The types include Ghiordes, Ladik, Ushak (source of the typical "Turkey" carpet), Anatolian, etc. Types of Caucasian carpets, the design of which is influenced both by Persia and by Turkey, are Daghestan, Shirvan, Derbent, Cherkess, and Karabagh. Central Asiatic rugs include Bokhara, Afghan, and Baluchi, and those from Chinese Turkistan, Kashgar, Samarkand, and Yarkand. Chinese carpets are easily recognised by their coarse texture, the characteristic patterns of dragons, stylised clouds, and flowers. They often have a border with the Greek key pattern. In



Louis XIV Royal Savonnerie carpet Late 17th cent

Spain mediæval woollen carpets were either copied from E patterns or of indigenous design, with heraldic representations. In France, the famous Savonnerie factory (founded in 1626) produced carpets which owed nothing to Oriental influence. Typical tapestry-woven carpets were made in the 18th cent at Aubusson, Beauvais, and elsewhere. In the 19th cent the Gobelins factory continued the work of the Savonnerie, which was closed.

In England a few home-produced carpets of the 16th and 17th cents are known. The design either followed Turkish models, or copied embroidery patterns, embodying heraldic devices. They occasionally bore dates, one bearing the date of 1570 has been preserved. The factory at Wilton was opened in 1701. Others followed at Kidderminster, Fulham (under George

II), and Paddington (1750). Axminster followed in 1755, and Dundee later. The Axminster factory closed down in the 19th cent., and Axminster carpets were thereafter made at Wilton. By a curious chain of circumstances, Brussels carpets are made at Kidderminster, Kidderminster carpets in Yorkshire, and Axminsters at Wilton and in London.

Machine-made carpets are divided into four main varieties—looped pile, cut pile (velvet pile), tapestry woven, and printed tapestries. To the first class belong Brussels carpets, to the second Wiltons, finest of all machine-made carpets. The standard Wilton carpet has c 90 points to the sq in and a pile c  $\frac{1}{4}$  in long. Some of the finer qualities, with a longer pile and a greater density, are nearly as hard-wearing as Persian carpets. Axminsters differ from Wiltons in having tufts inserted in the surface of the fabric. A variety is the chenille Axminster. Tapestry carpets are made with a looped or cut pile. Kidderminster or ingrain carpets are of the tapestry class. Printed tapestries include the jute squares of Dundee and the so-called art carpet. Machine-made carpets of all qualities are made in standard widths, often 27 in for "body" carpet, and 18, 22½, or 27 in for stair carpet. A modern development is the seamless carpet, which can be woven in any width up to 33 ft.

Carpets are an excellent example of the proverb that "it is cheapest to buy the best." A first-class Wilton, costing originally perhaps three times the price of a printed "art square," will outlast six of the latter, and for practically the whole of its life it will give to a room an air of comfort and luxury that can never be obtained with the cheap floor-covering. Persian, Chinese, and the finest Indian carpets will last for a hundred years or more with reasonably careful treatment.

**Carp-Louse**, a degenerate Crustacean (*q v*), of the sub-class *Copepoda*. It has a flat oval body, and attacks

of lime water and linseed oil sometimes olive-oil it is a celebrated soothing lotion for burns It takes its name from the Carron iron works in Scotland where it was first used It is smeared over the burnt part with a feather or lint may be soaked in the oil and placed on the skin afterwards being covered with cotton wool

**Carrot**, belongs to the family *Um bellifera* and has the characteristic much-divided leaves and a large inflorescence of yellow flowers in a compound umbel The tap root is much developed in cultivated species and is a pinkish colour when lifted from the soil darkening in the air to brick red It requires soil of considerable depth for its strong deep roots and prefers good sandy loam The plants should be thinned when 3 in. high. *See also* CAROTENE

**Carson, Edward Henry Baron** (1854-1933) British statesman and lawyer was educated at Trinity College Dublin and became Crown Prosecutor during A. J. Balfour's secretaryship for Ireland He was elected Unionist M.P. for Dublin University in the British Parliament of 1892 and called to the English bar in 1894 He helped to defeat Gladstone's second attempt to pass an Irish Home Rule Bill His success at the English bar led to his appointment as Solicitor-General (1900-6) As leader of the Irish Unionists Carson opposed the Irish Home Rule Bill and the Parliament Bill (1911) and in Belfast organised Ulster's opposition to Irish Home Rule This involved the formation of a volunteer force (1912) in 1913 he supervised the establishment of a provisional government by the Ulster Unionist Council On the outbreak of war he took up recruiting work in Ulster and became Attorney-General under Asquith (1915) He resigned over the question of the relations of Crete with the Allies but was appointed First Lord of the Admiralty in Dec. 1916 He joined the War Cabinet without portfolio in July 1917 and assisted in assembling the Irish

Convention Carson resumed Irish politics after the Armistice but Lloyd George's proposal to give separate Parliaments to Northern and Southern Ireland caused him to change his attitude and in 1919 he worked successfully for a Unionist majority in the first Ulster Parliament He was created Baron Carson of Duncairn (1919) and Lord of Appeal

**Carson City** capital of State of Nevada U.S.A. situated near the W. border and not far distant from the Sierra Nevada Gold and silver mining is carried on in the district and there is some agriculture Pop. 1550

**Cartagena** (1) Port and city in the S.E. of Spain long famous for its natural harbour and mineral wealth and now the principal Spanish naval station Its exports include lead zinc iron and copper with some dried fruit and olive oil Coal coke and machinery are imported from England Cartagena was built by the Carthaginian Hasdrubal in 42 B.C. captured by the Roman Scipio Africanus and occupied later by the Goths and the Moors It was taken by the British in 1806 but recaptured by Spain in the same year Pop. 97,000 (?) City Colombia on the Caribbean sea capital of department of Bolivar pop. 90,500

**Cartels** *see* COMBINES TRUSTS AND CARTELS

**Carter Howard** (b. 1873) Egyptologist and archaeologist He was associated with the 5th Earl of Carnarvon in discovering the tomb of Tut Ankh Amen in the Valley of Kings Egypt Other important discoveries include the tombs of Thothmes IV Mentuhotep and Hatshepsut. Was for some years Inspector General of Antiquities to the Egyptian Government with whom he later had protracted litigation over the rights to the Tut Ankh Amen discoveries

**Carteret, Sir George** (c. 1610-1680) English admiral born in Jersey He was appointed Comptroller of the English Navy in 1639 and Lieutenant Governor of Jersey in 1643 During the Civil War he served on a privateer

**Carrier**, a person who undertakes the carriage of goods. He may be a *private carrier*, i.e. not bound to carry the goods of everyone who wishes to employ him. His position is that of a bailee, and in the absence of agreement to the contrary, he is liable only for loss of or damage to the goods carried resulting from negligence or lack of skill on the part of himself or of those for whom he is responsible, in regard either to the vehicle supplied or the course of carriage. A *common carrier*, on the other hand, is one who professes to carry for reward goods delivered to him by any person who chooses to employ him. He is answerable for every loss of or injury to the goods unless caused by an act of God or the King's enemies, by the negligence of the consignor, i.e. sender of the goods, or by some defect in the goods themselves. His liability begins when he takes the goods in his custody and ends when he has delivered them within the time stipulated, if any, to the consignee or some duly authorised person. He is liable for misdelivery, or for a refusal, even though based on mistake, to deliver to the right person. He can limit these obligations by making a special contract, but not, in the case where he is not protected by the Carriers Act, 1830, by mere public notice. But he is not liable for certain kinds of articles enumerated in the Act, when their aggregate value exceeds £10, or £25 in the case of railways, unless the value and nature of the goods shall have been declared at the time of delivery and the necessary insurance charges paid.

A carrier may sue for his freight and has a particular lien (*q v*) on the goods. The consignor is bound to inform him of any dangers inherent in the goods of which he is aware, for the carrier is not bound to carry dangerous goods, and if the consignor fails to give full information, the carrier will have a right of action for damage caused by such dangers. In the case of railway companies, it is a punishable offence to deliver dangerous, explosive, or cor-

rosive goods without disclosing their nature. Railway, canal, and navigation companies may be either common or private carriers, according to the circumstances of the case. As regards goods which they profess to carry for persons generally, they are common carriers. In any case, the general effect of the statutes, particularly the Railway and Canal Traffic Act, 1854, is to prevent such companies from entering into special contracts limiting their liability under Common Law with respect to the goods they carry, unless the conditions of the special contract are just and reasonable, and the contract is a written contract signed by the consignor. A provision that "the company will not be responsible for any injury or damage, however caused," to livestock has been disallowed, so too, a clause that the company will not be responsible for luggage unless fully and properly addressed with the owner's name and destination. With regard to passenger's *personal* luggage, the company is usually treated as a common carrier and must provide reasonable facilities for its carriage, usually free up to a certain weight. Of course, if the passenger takes the luggage into the carriage with him, he is generally assumed to have himself the entire control of it and is himself responsible.

**Carroll, Lewis**, pen-name of Charles Lutwidge Dodgson (1832-1898), mathematician and author of *Alice in Wonderland*. He was a lecturer at Oxford, and published many important mathematical treatises. He is better known, however, for his "nonsense" books, *Alice's Adventures in Wonderland* (1865), *Through the Looking Glass* (1871), and *The Hunting of the Snark* (1876) are the most popular. The original of Alice was a daughter of Dean Liddell.

**Carronade**, a ship's cannon usually carried by frigates, and designed in 1759 from a very early piece with wide calibre and a powder-chamber. It was named after the Carron iron-works, where the pieces were founded.

**Carron Oil**, a mixture of equal parts



on behalf of the Royalists. He surrendered Jersey to the Parliamentarians in 1651, and joined the French Navy. After the Restoration he was elected M.P. for Portsmouth, was Treasurer of the Navy from 1660 to 1667, appointed Deputy-Treasurer for Ireland in 1667, and later Commissioner of the Admiralty. Charles II and James granted him territory in America, including the tract later named New Jersey in Carteret's honour.

**Carthage**, one of the wealthiest and greatest cities of the ancient world, situated on the Gulf of Tunis, with Cape Bon on the E and the modern Porto Farina on the W. There were two harbours, one military and the other commercial, the military harbour is believed to have been capable of holding more than 200 ships. The city was built by the Phœnicians in the 9th cent. B.C., and became their most important N. African centre, its inhabitants were distinguished by their great commercial aptitude and genius for navigation. The principal interest of Carthage is concerned with its Greek and Roman wars, its fall, rebuilding by the Romans, and final destruction by the Arabs in A.D. 698. By the 6th cent. B.C. Carthage dominated the Mediterranean, and had an agreement to this effect with Rome. Anxious for further conquests, she made attempts on Sicily, and war for its possession with the Greeks went on for upwards of a century, with brief intervals until the Carthaginians eventually secured possession of the island. It was not long before the Romans, inspired by their military victories, began to dispute this possession, and the first Punic War (264-41) broke out, Carthage being defeated.

After a Civil War the Carthaginians began the conquest of Spain and, as they were again at the summit of wealth and importance, made good progress. The second Punic War (218-201) supervened, and under their great general Hannibal, the Carthaginians achieved conspicuous success. Hanni-

bal, however, was not supported from home, and the Romans defeated his brother and pushed their attack towards Carthage itself. Hannibal hastily returned, but was defeated, and the subsequent treaty stripped Carthage of all her possessions outside Africa. In spite of this, the city soon began to flourish again, and Rome became more and more uneasy, Cato constantly declared that Carthage must be destroyed, and in 149 B.C. the third Punic War began, lasting 3 years and ending with the fall of Carthage in 146 B.C. Thereafter the Romans established a new city, which became of considerable importance in the Christian era, and was the residence of both Tertullian and St. Cyprian. In A.D. 439 the Vandals took the city, which degenerated into a pirates' lair. They were followed in 553 by the Byzantines, who restored it. Finally, the Arabs took possession in 697, and effected the destruction of the entire city in the following year.

**Carthusians**, an order of monks founded in the 11th cent. by St. Bruno, who follow a very strict rule and lead a largely secluded life. The name of Charterhouse (*qv*) was given to their monasteries in England, and Chartreuse (*qv*) in France.

**Cartier** [*pron* KARTYĀ], Jacques (c. 1491-1557), the first European to navigate the St. Lawrence R., Canada. He went up to what is now the city of Montreal, then an Indian village. He made several voyages from his home port, St. Malo, to Newfoundland and the St. Lawrence, making fresh discoveries each time, but retired at a comparatively early age.

**Cartography**, *see* MAP PROJECTIONS AND CARTOGRAPHY.

**Cartoon**, originally a full-size preliminary drawing or sketch, made preparatory to the execution of a design in oils, tempera, mosaic, tapestry, etc. In the latter case the weaver works above the cartoon, which guides his movements. To-day, the word usually signifies a satirical sketch appearing in a newspaper, often

with a political subject and is practically synonymous with caricature (q.v.)

**Cartouche** (καρτούσι) originally a roll of paper to hold powder as a fire arm charge (corrupted into *cartridge*). By extension, an architectural scroll form and in later times a decorated oval in which a name title or coat-of-arms can be displayed.

**Cartridge** the case and enclosed charge of an explosive projectile used in small arms.

**Cartwright, Edmund** (1743-1833) English inventor made possible the application of machinery in the weaving industry. In 1785 he patented his first power loom and in 1789 a wool carding machine. These innovations were not well received by workers; one of his mills at Manchester was the object of incendiarism and he gained little profit from his inventions until in 1809 he was voted by Parliament £10,000 with which he retired.

**Caruso, Enrico** (1873-1921) Italian tenor was born at Naples and made his debut there at the age of 21. He

soon became extremely popular all over the Continent and came to London in 1901 where he was no less enthusiastically received. There followed sensational successes in N. and S. America; he sang to an audience of 14,000 in Mexico City. He became one of the favourite artists with Covent Garden audiences and made history with the glamorous Melba and Caruso nights.

Caruso's voice was one of phenomenal power, warmth and flexibility. He excelled in the music of Verdi and Puccini and was superb as Camilo in *La Traviata*. He was one of the first singers to record successfully for the gramophone.

**Carving** the art or method of dividing meat, fish, poultry or game into neat portions for the table. Cutting is usually across the grain. When a joint is served cold the underside should be carved first leaving the upper joint with a neat appearance for subsequent serving.

A lobster's claws are removed first.

## CARVING



turkey



goose



duck



partridge



hare



pigeon



chicken



lobster



leg of mutton



ham



sole



salmon



turbot



then cracked and the flesh cut away Greenish parts near the head, the gills, and the intestines must be removed, then the lobster cut as in the diagram *Crabs* are treated similarly *Fish* are usually cut along the backbone, or the flesh removed in two flat halves *Salmon*, however, may be cut crosswise into fillets, as also with haddock and whiting

Beef *brisket* is cut right across, thinly *Ribs* are cut between the bone and flesh at the heavy end, and the meat is removed in thin slices A *round of beef* is straightforward except at the end, and only a very keen knife can slice it thinly to the bottom A *sirloin* should be held upright so that the undercut will come away easily in thick slices, and finally cut as for ribs

A *leg of mutton* is best carved on a slant with the thick end towards the left and the rear end of the joint slightly raised Cut thick slices from the middle right down to the bone, working toward the thick end If the joint is to be served cold afterwards, it is best to slice from the under part, the way of the bone, leaving the upper part intact for the second meal For a *shoulder*, raise slightly and cut down about midway in thick slices Carve meat on top of the blade in thick narrow slices parallel to the ridge Carve a *saddle* in thick, narrow slices, the way of the back bone Serve a fat piece with the lean from the back

If a *calf's head* is not boned before serving, cut slices from ear to nose, serving it with sweetbread from the throat. The eye, palate, and brains are considered succulent morsels by some, but should be served only as requested

Cut *ham* thinly, beginning at the knuckle

In serving *fowl* remove the legs and wings, cut the breast away in two pieces if small, or with slanting slices if large Remove the wish bone and trim the fowl With *goose and duck* carve the breast first, cutting thick slices down on to the breast bone. Serve

*pigeon* in two halves. Game is carved according to size

Cut a *hare* along the back, then into sections

**Cary, Henry Francis (1772-1844)**, translated the *Divina Commedia* of Dante into English blank verse (1814)

**Caryatid**, an architectural term applied to a female figure, generally draped, used as a support The most famous examples are those of the Erechtheum at Athens, but the use of caryatids was widespread among Greek and Roman architects, and was revived during the Renaissance At St Pancras Church in London is an example of their reappearance in more modern times Corresponding male figures are called *Atlantes*

**Casablanca**, port on the NW coast of Morocco, some 150 m W of Fez It is a thriving centre of trade, possesses an excellent harbour, and is of great economic importance to the country. Hides, grain, and wool are the chief exports Pop 161,000.

**Casals, Pablo (b 1876)**, Spanish violoncellist, born at Vendrell, near Barcelona He first appeared in Paris and London in 1898 In addition to being a violoncellist of the first order, he is an accomplished conductor

**Casanova de Seingalt, Giovanni Jacopo (1725-1798)**, Italian adventurer, when 16 was turned out from a seminary, and thereafter spent his life wandering through Europe From France, Italy, Russia, and Spain he was continually expelled He visited England between 1761 and 1764 An account of his amazing life appears in his *Mémoires* (published 1826-38) In spite of his reputation, he was favoured by the Pope, Frederick II of Russia, and King Stanislaus of Poland

**Casaubon, Isaac (1559-1614)**, Anglo-French scholar, famous editor of Greek authors He is best known for his edition with notes of Theophrastus's *Characters*

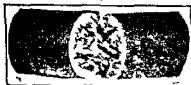
**Cascade Mountains**, a mountain range of the USA and Canada, crossing Oregon and Washington and ending in British Columbia It is 100-150

m from the Pacific coast and mingles at its N end with the N Rockies. Most of the peaks are volcanic cones the highest being Shasta (14 161 ft) Rainier (14 408 ft) McLoughlin (9493 ft) and Hood (11 225 ft). The range is cut by several rivers including the Fraser Columbia and Klamuth and their cascades give it its name.

**Cascara**, a purgative used in medicine and composed of a dry extract compounded into pills or a liquid extract of the bark of the California buckthorn *Rhamnus purianus*.

**Cascarilla** is the bark of a tree of the spurge family giving out a musky odour when burnt. It has tonic and stimulant properties and is often used in pastilles.

**Case-hardening** a process by which the surface of articles of soft iron or mild steel is converted into a high carbon steel which can be hardened by quenching. The process is of the



Case-hardened bar showing two textures of metal. The greatest value for many small machine parts since the resistance to wear and other qualities of the hard steel are combined with the toughness and absence of brittleness of the soft core. The material can also be worked to shape in the soft state which is an advantage as regards cost.

Case-hardening is effected by burying the article in charcoal powder and heating it to a temperature of 800-900° C for a few hours or even days. The charcoal used is generally of animal origin. See also IRON AND STEEL.

**Casein** [pron KĀ SĒIN] or *Caseinogen* is a protein (q.v.) belonging to the group known as albumins (q.v.). It is to be found in the milk of all animals and can be precipitated therefrom by

addition of a mineral acid which decomposes the calcium caseinate present. The yield of casein from an average skim milk is about 3 per cent. The acids usually employed to precipitate it are dilute sulphuric hydrochloric or acetic acids or else lactic acid produced by souring the milk with rennet. This last method however gives a somewhat smaller yield than does the use of mineral acids. The casein thus precipitated is washed and dried and is then ready for industrial use. Casein may also be obtained from vegetable sources such as soya and castor beans by extraction with alkaline media such as sodium carbonate solution.

Casein is used for a very large number of purposes chiefly perhaps for the manufacture of plastics (q.v.). For this purpose it is moistened with water and pressed in a mould to the required shape. It is then soaked in formaldehyde solution which causes it to harden and become waterproof.

Casein has a high nutritive value and is much used as a foodstuff especially in patent foods. It is also used as a size and as an adhesive. See also ADHESIVES.

**Casement, Roger David** (1864-1916) Irish rebel. Born at Kingstown, co. Dublin he entered the British consular service and served as Consul at Lourenço Marques Loanda and Boma. He was knighted by the British Government for his services in enquiring into the activities of the Anglo-Peruvian Company in 1910. On the outbreak of the World War he took up the cause of Irish independence visiting the United States and Berlin (Nov. 1914) but finding that German aid was not forthcoming he endeavoured to prevent an abortive rising. When the rising of Easter 1916 was being planned he left for Ireland in a German submarine escorted by a ship carrying arms. He was captured on the Irish coast tried for high treason and hanged at Pentonville on Aug. 3.

**Cashel**, town of the Irish Free State

in Tipperary County. At the summit of the Rock of Cashel are interesting remains, including those of St Patrick's Cathedral, Cormac's chapel, and the cross where the Kings of Munster were crowned. It is a Catholic archbishopric. Pop 3000

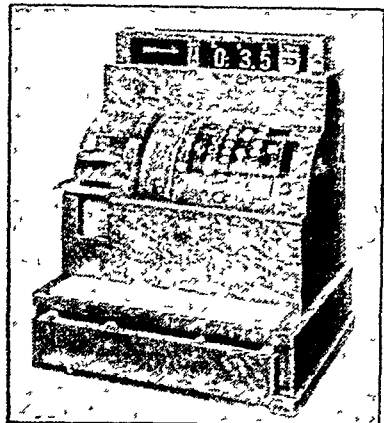
**Cashew Nut**, the edible seed of *Anacardium occidentale*, a tropical tree belonging to the same family as the pistachio nut tree

**Cashmere**, see KASHMIR

**Cashmere Goat**, see GOAT

**Cash on Delivery (C O D)**, a system by which payment for goods may be made to the agent who delivers them, thus avoiding both payment in advance and standing credit. Common in private business it was introduced as a public service by the Swiss Post Office in 1849, and is now operated by postal organisations in nearly all countries. The charges in Great Britain are up to 10s. 4d., up to £1, 6d., £2, 8d., £5, 10d., each further £5 or fraction thereof, 2d., by rail, 3d. extra, maximum, £40

**Cash Register** A device for keeping a continuous record of cash transactions, as in retail selling. In its simplest form it consists of a till drawer, a keyboard, and an adding



Cash Register

machine, the amount of a given transaction is registered by depressing keys, which at the same time cause the amount to be exhibited by indicators to the salesman and the customer. The machine has been elaborated by the addition of paper rolls upon which a receipt is printed, and by a number of devices which enable one machine to be used by several persons, separate totals being calculated, as well as a general total. In spite of its cost, the machine forms so strong a safeguard against mistakes and dishonesty that it has come into very wide use. See also CALCULATING MACHINE

**Casimir III and IV, Kings of Poland.** CASIMIR III, THE GREAT (c 1309-1370), succeeded his father, Wladislaus, in 1333. He made peace with the Teutonic Order in 1334 and 1343, allied himself with Charles Robert, King of Hungary, and reconciled his rival, John, King of Bohemia, in 1335. He acquired control, with Hungary, over Red Russia (Galicia) in 1344, and defeated John of Bohemia over the Silesian dispute, peace being signed in 1346. Casimir supported the cities and peasants against the aristocracy, reorganised Polish finance, and codified the laws. In 1364 he founded the University of Cracow. He was succeeded by Charles Robert's son, Louis.

CASIMIR IV (1427-1492) was crowned in 1447. He devoted himself to the preservation of the Polish-Lithuanian union, and, under the compulsion of his nobles, instituted an elective monarchy. Subduing the Teutonic Order, he acquired control over the Prussian provinces in 1454. War with the Order again broke out, but by the peace of Thorn in 1466, W. Prussia and Pomerania were ceded to Poland. Casimir was a patron of culture, establishing schools for all classes, and promoting the printing of literature.

**Casimir-Périer, Jean Paul Pierre** (1847-1907), 5th President of the 3rd French Republic, was elected President in 1894, retiring 15 Jan next year. He was a valuable supporter of Dreyfus at the latter's trial.

**Casino** (Ital. little house) public place of entertainment for concerts, dances etc. usually including a café and gambling rooms. The name is also given to a card game for 2 to 4 players played with a full pack of 52 cards.

**Casket Letters** letters supposed to have been written by Mary Queen of Scots to the Earl of Bothwell and indicating her part in the murder of her husband Lord Darnley. A long controversy has raged round the question of their authenticity.

**Caslon, Wm** (1691-1766) was born at Cradley Works. In 1716 he was established as a London engraver of the highly decorated gun locks and barrels of the period. He also specialised in cutting the shapes that bookbinders used for tooling the beautiful leather bound volumes of the day and was thus brought into contact with the printing trade.

He was encouraged by Wm Bowyer to set up a type factory where he cast so clear and legible a letter that he soon secured the patronage of the finest printers in England and on the Continent. His business was continued by his son William (1720-1778).

**Caspian Languages**, a sub-group of the Iranian group of Indo-European languages (qv) comprising about five languages of which only Mazandarani has developed a literature.

**Caspian Sea**, large inland sea in the S.W. of Asia, bounded N. by Russia, S. by Persia, E. by Transcaspia (Turkistan) and W. by Asia Minor and Russia. It lies below sea-level is of irregular shape with its greatest length N. to S. and has a huge shallow, silted area in the N. which extends round all the coasts. On the E. are two large bays the Casarevich and the almost landlocked Gulf of Karabugaz and on the W. the Apsheron peninsula springs from the Caucasus Mountains.

The Caspian has many affluents the chief being the Volga (N.) the Ural (E.) the Emba (N.E.) the Kura (S.W.) and the Terek (W.). Chief ports are Krasnovodsk, Resht and Baku. shipping consists mainly in

the transport of agricultural produce and petroleum. The Caspian is connected by rail with the Black Sea some 300 m. to the W. and by canals and by Rs. Volga and Dvina to the Baltic. Area c. 100,000 sq. m.

**Casquets** (or *Caskets*) islands in the English Channel situated near Alderney. They are very dangerous to shipping being small and extremely rocky and have been the cause of numerous shipwrecks.

**Cassandra** (KASAN DRO) legendary Trojan prophetess whose forecasts of disaster were never believed. She foretold the fall of Troy and the murder of Agamemnon.

**Cassation, Cour de** (Fr. *casser* to quash) the highest court of appeal in France.

**Cassava** is the starchy matter stored in the roots of a big tropical shrub belonging to the spurge family. It is washed and roasted to remove a poisonous narcotic substance found with it and made into cassava bread. Tapioca is a product of bitter cassava.

**Cassel**, German city, capital of Hesse-Nassau situated on the R. Fulda. It is a notable railway centre connecting with the Ruhr, Frankfurt, Berlin and Leipzig. Industries include railway engineering, iron founding and textiles. Cassel possesses a valuable picture gallery and the former palace of the Electors. Pop. 150,000.

**Cassel, Sir Ernest Joseph** (1851-1911) Anglo-German financier was born in Cologne. He joined the house of Bischoffsheim and Goldsmid, London bankers in 1880. He took up S. American affairs in 1884 re-establishing Uruguayan finance and raising loans for Mexico. He financed the Royal Swedish Railway, the construction of the Central London Railway and the Nile irrigation scheme and assisted in founding the National Bank of Egypt. He retired in 1910. Cassel endowed many hospitals and educational institutes and was a close friend of King Edward VII.

**Cassia**, see SPICES AND CONDIMENTS

**Cassiopeia** [KA'SEÖPE'A] (1) also *Cassiope* and *Cassiopea* mythical Queen of Ethiopia, mother of Andromeda. She was punished for boastfulness by Neptune, who sent a sea-monster to devastate the land. Andromeda was chained to a rock in the monster's path, but was rescued by Perseus. (2) *see* CONSTELLATIONS

**Cassiterides**, name given by the ancient geographers to a group of tin-producing islands believed to be off the N W coast of Spain. The Cassiterides have been variously identified with N W Spain, Cornwall, or the islands off the Brittany coast.

**Cassiterite**, oxide of tin, and the chief ore from which the metal is obtained. It occurs usually as black or brown heavy crystals with a brilliant lustre. It is usually associated with granites, as in Cornwall, where it is mined, and was formed by hot vapours which rose at a late stage in the granite intrusion and interacted on the rocks as they passed, forming veins of the mineral. The Cassiterite may be weathered away from these veins and deposited in river-beds as a placer-deposit, this being the source of much of the present tin-ore, as in Tasmania and the Malay States, as well as in Cornwall.

**Cassius, Gaius**, one of the murderers of Julius Caesar, commanded the Roman fleet on the Asiatic coast in 43 B C, and after the battle of Philippi joined Pompey. When Agrippa defeated the latter, Cassius joined Antony and was with him at his defeat at Actium. He was executed by Octavian at Athens.

**Cassivellaunus**, a British chieftain, ruled the district N of the Thames. He opposed Julius Caesar on his second invasion in 51 B C, but was finally defeated, and paid tribute to the conqueror.

**Cassock**, a closely fitting, ankle-length vestment of the Christian Church, black for priests, and purple for prelates. In the Roman Church, Cardinals wear a red and Popes a white cassock. It is seldom worn as

an outdoor garment in Protestant countries. *See also* VESTMENTS

**Cassolettes**, culinary cases consisting of fried egg and breadcrumbs, or fried potato coated with egg and breadcrumbs, in which meat, etc., is placed.

**Cassowary**, a large flightless bird allied to the Emu (*qv*), which it resembles in having the contour feathers composed of two equal shafts. Its distinctive features are a horny helmet on the head, a naked neck provided with wattles, and an enlarged inner claw of the foot. Cassowaries are found in the Papuan Islands and Queensland, and are represented by several species. The eggs, dark green in colour, are laid on the ground, and are incubated by the cock bird.

**Castagno** [*pron* KASTAN'YO], **Andrea del** (c 1400-1457), Florentine painter. One of his few surviving paintings hangs in the National Gallery. Castagno painted in the manner of Giotto and Masaccio, introducing an appearance of reality and of three-dimensional form into his work, thus assisting in the liberation of Italian painting from the archaic and formal convention of the Byzantines.

**Caste**, a clearly defined group or class within a society, usually used in connection with the Indian system, and derived through the French from the Portuguese "*casta*," meaning "breed," which in turn comes from the Latin "*castus*" ("pure"). The Indian caste system may be originally traced to the incursions of comparatively advanced Aryan conquerors, who desired to maintain the purity of their race by making the primitive aboriginal inhabitants into a menial and socially degraded class, with whom inter-marriage should be impossible. This plan was probably developed and extended to cover subdivisions of half-castes by the all-powerful Brahmans or priests. The system was regularised by the *Laws of Manu*, compiled from traditional sources c the 1st cent, which recognised 4 main castes—the Brahmans or priests, the Kshatriyas or warriors, the

Vaisyas or merchants and the Sudras or labourers together with their numerous half and quarter castes. Every possible penalty was attached to marriage into a different caste in order to ensure purity of blood and the maintenance of clear distinctions between castes. The caste-system is based on the Hindu idea of reincarnation different men being regarded as occupying different positions on the ladder of development and therefore as innately unequal. It is the antithesis of the Western conception of democracy.

In course of time the original idea of caste became lost and purely arbitrary deprecation of certain trades such as basket making tanning pottery etc crept in. At the present time caste is so rigid that an upper-caste Hindu will not come into contact with a lower nor even use the vessels which he has used. Many of these regulations with regard to food washing etc are clearly of a hygienic as well as a religious nature. To-day there are c. 3500 castes and sub-castes in India. The result is a kind of social bureaucracy in which each individual has his fixed place above which he can rise only in the most exceptional circumstances. In order to preserve the *status quo* freedom of marriage-choice is entirely forbidden to women and betrothals within the caste or even within a small caste group are arranged at any time from the pre natal period onwards. Rites rituals and ceremonies vary from caste to caste and those relating to birth marriage and death are so extensive that they form the almost exclusive occupation of the poorer classes leisure time. At the same time caste fulfils an economic function in preventing the migration of labour from the occupations of one caste to those of another.

The greatest blot on the caste system is the treatment of the untouchables or lowest degraded classes which are not even included in the caste ladder. They are forbidden to come within a considerable distance of

upper-caste members are forced to drink at their own wells and are denied the most elementary rights of protection and humanitarian treatment. This exclusion is not however inherent in the traditional system and is now being attacked by many high caste Hindus including Gandhi.

**Castello Branco, Camillo** (18 — 1890) Portuguese novelist wrote romances (e.g. *Os mysterios de Lisboa* 1854) novels descriptive of the Portuguese society of his day and historical and literary works. His best work is in the *Nocturnos do Afonso* (1869).

**Castelnau, Edouard de** (b. 1851) French general was trained at St Cyr military school and served in the Franco German War. When the World War broke out he commanded the 2nd Army in Lorraine. In 1915 he commanded the armies of the French centre in the Champagne offensive. He was appointed chief of the general staff under General Joffre.

**Castiglione Baldassare** (1478-15 9) Italian author served on many important diplomatic missions for the Dukes of Urbino but is best known for his famous book *Il Cortesano* (published at Venice 1528). In this work the character of the perfect courtier is debated and described. It is one of the most important prose works of the Renaissance.

**Castile**, historically one of the two principal divisions of Spain. It consisted of Old and New Castile and when these were united with Aragon in 1474 through the marriage of Ferdinand and Isabella the beginnings of modern Spain were formed. Castile was bounded N by the Bay of Biscay and S by Andalusia. Conquests over the Moors led to its extension until it included the whole of Central Spain. The principal towns include Toledo Valladolid Burgos and Ciudad Real.

**Castilian Language** [KASTILYŌN]  
see SPANISH LANGUAGE

**Casting of Metals.** The art of forming metals by melting and casting them into moulds is very ancient, and

its discovery cannot be much more recent than the use of metals themselves. The operation was brought to a high degree of perfection in ancient times, the use of bronze for statuary makes very high demands on the art of the foundryman. The Chinese had mastered this art in the 3rd millennium B.C., and the Minoans and Egyptians were also acquainted with it. Castings are made from patterns, that is to say, models shaped to the form of the finished article, but slightly larger in size owing to the amount which has to be allowed for shrinkage of the metal. This allowance varies with different metals, being in the case of cast iron about  $\frac{1}{16}$  in per ft., but differing slightly according to the thickness and shape.

The making of wooden patterns is a highly skilled operation, though the invention of plastic wood has facilitated it very greatly, it also demands a knowledge of the process of moulding and casting. *Moulds* for casting are usually made in moulding sand, which consists of ordinary sand with an admixture of clay, the mixture may be either natural or artificial. The sand is moistened so as to make it cohere, but it must not be too wet, the molten metal generates steam, and this, as well as the air trapped by the molten metal, must be allowed to escape. The mould is formed in a "box," or rather a pair of similar boxes, which can be taken apart for the removal of the pattern. In the process of embedding, a dusting of non-coherent sand is given at the surface between the two boxes, when these are taken apart the pattern can be lifted out, leaving a hollow into which the melted metal is poured. In the operation of moulding, the foundryman cuts or moulds the necessary channels by which the melted metal is poured in, and by which the air escapes from the mould. Frequently a number of small objects are moulded in one large moulding box, and these are then connected by channels, which fill with metal that has to be cut away after

casting. Generally speaking, patterns cannot be made to "draw" out of the sand in this simple way, and the operation of moulding becomes more difficult.

It is, however, frequently impossible to avoid the use of a *core*, that is, a piece of moulded material which is more or less completely surrounded by the metal when casting takes place; as for example when a hollow vessel with a small opening is cast. Cores have to be made of more coherent material than ordinary moulding sand, and are baked in a stove before being set in place. The pattern-maker provides "core boxes", instead of making a hollow where the hollow is to be in the finished casting, he leaves this solid, and adds to it at the opening a projecting piece, which he also adds to the shape of the interior given by the core box. This provides for the core a socket in the moulding sand which takes the projection moulded on the core.

In recent times the moulding of small castings has been greatly facilitated by the use of machinery, ranging from all kinds of aids to the hand moulder, to machinery which almost dispenses with skilled labour.

For the more fusible metals, plaster of Paris moulds are very suitable. Objects can be modelled in plasticine or modelling clay, which can be removed as soon as the plaster has set. It is essential that the plaster mould should be thoroughly dried, or the casting will be ruined by the generation of steam. Plaster moulds may also be used for brass, but they require still more thorough baking. The mould should be smoked over a candle or the flame of burning resin, and should be warmed before pouring.

Bronze sculptures are moulded either by sand, a plaster cast being made from the original clay and used as a pattern, or by what is called the *cire perdue* (qv) process. See also BRONZE AGE.

**Casting Vote**, deciding vote recorded by the chairman of a meeting, when

the number of votes for and against a motion is otherwise equal. In the House of Commons the exercise of a casting vote belongs to the Speaker.

**Castle** (Lat. *castellum* = a little fort) a fortified building introduced into England in Norman times when the stone castles of the feudal barons took the place of the earlier earth works and palisade defences. The Norman castles also served as garrison centres from which authority could be exercised and borrowed their chief characteristic of a fortified donjon or keep within an outer wall from the earlier French examples such as those at Chauvigny, Falaise and Loches. Towards the end of the 12th cent. there were over a thousand baronial castles in England each the stronghold of a more or less independent tyrant. Many of these were destroyed by Stephen. The keep was a huge square edifice with very thick walls entered on the first floor by a ladder and lit only by the narrowest loop holes. In the basement and on the ground floor prisoners and stores were kept; next came the soldiers' quarters and the armoury; while on the second floor was the baronial hall and above the living rooms the whole being crowned with battlements.

A thick wall lined with storehouses and barracks surrounded the bailey or courtyard and was crenellated punctuated by round towers or bastions and pierced by a postern and a main gate. The latter was closed by a portcullis while a drawbridge could be raised or lowered to connect it with the farther side of the surrounding moat. Of this earliest type Rochester Castle and the central portion of the Tower of London are excellent examples. As time went on, a rising standard of living caused an increase in the size and convenience of castles at the expense of their invulnerability. At Conway Castle the transition is witnessed: strong fortifications still being maintained. Gradually with the suppression of baronial powers and increasing peace throughout the country

castles underwent gradual development into country mansions every stage of the change having left its monuments from Carnarvon Castle by way of Windsor to that of Warwick. See also FORTIFICATIONS.

#### Castle Puddings, to make.

- 2 eggs
- 3 oz butter
- 3 oz flour
- 3 oz castor sugar
- $\frac{1}{2}$  teaspoonful baking powder

Cream butter and sugar and add beaten eggs slowly with a little of sieved flour. Sift in remainder of flour with baking powder. Mix well. Half fill 7 or 8 dariole moulds (qv) with the mixture. Steam 30-40 minutes or bake in a moderate (375° F) oven 0-30 minutes. Decorate with cherry and serve with jam sauce (see SAT CHS).

**Castlereagh Viscount** (Robert Stewart, Marq. of Londonderry) (1763-18 ) British statesman. Born in Donegal he was educated at Cambridge and elected M.P. for co. Down in 1790. He was Chief Secretary for Ireland from 1798 until the Act of Union in 1800. Castlereagh advocated Catholic relief and tithe reform in Ireland. He was Secretary for War under Portland (1805) defending Wellesley's campaign in Portugal. The Walsheren failure of 1809 led to a dispute and duel with Canning then Foreign Secretary. Castlereagh was appointed Foreign Secretary and Leader of the Commons in 1810 - being responsible for England's policy against Napoleon. Castlereagh preserved the Great Alliance against him (Treaty of Chaumont 1814) and secured support for Blücher. At Vienna in Jan 1815 he countered Russian ambition in Europe. He was largely responsible for the peace agreement after Waterloo and advocating conciliation with France and opposing Metternich's reactionary policy through the Holy Alliance. A critic of the Troppan Protocol of 1810 he supported Canning's policy of non intervention and maintained Greek independence. He died by his own hand.



**Castletown**, seaport on S coast of the Isle of Man, at one time its capital. Castle Rushen is said to have been founded in the 10th cent, and was the home of the lords of Man until the 18th cent. Near the castle is the old House of Keys, the seat of the Manx Government until its removal to Douglas. Castletown has a small trade in shipping, and supports a pop of just under 2000.

**Castor and Pollux**, mythical twin brothers, the sons of Jupiter and Leda (*q v*), were two of the Argonauts, under Jason. They accomplished many great deeds, and were adopted as the protectors of sailors. Castor was killed at the nuptials of Idas and Talaira, but Pollux prayed Jupiter that his brother might be, with him, granted immortality, his prayer was answered, but they were allowed only to live on alternate days and never together. They have given their names to the two chief stars in the constellation *Gemini*.

**Castor, to Repair**, *see* REPAIRS, HOUSEHOLD.

**Castor Oil**, oil obtained from the castor seed. It is used for lubricating internal combustion engines and also medicinally as a cathartic. *See also* OILS, FATS, AND WAXES.

**Casual Labour**, the body of labour which adapts itself to the particular seasonal or other requirements of industry, moving irregularly from one occupation to another. Casual labour may be paid by the day or the hour, and is usually engaged for the duration of a particular job. It is most common in the docks, where the loading and unloading of each ship is an individual process, and where work may fluctuate according to fog, wind, tide, the state of trade, or the popularity of the particular locality. A body of labour adequate for the maximum demand must be available, and so there will nearly always be a margin without employment. In 1912 a system of registration was adopted in Liverpool, where there was a margin of something like 10,000 men, tallies being issued to

registered dockers, and reforms in the payment of wages and distribution of labour being instituted. Since 1924 registration schemes have been almost universally applied. At the Port of London 61,000 tallies were issued in 1920, but this number was reduced to 40,000 by 1927, the margin of casual labour being thereby minimised. Casual labour is also common in ship-repairing and the transport trades, and seasonal casualisation is frequent in building, agriculture, and similar variable industries.

**Casual Ward**, an establishment provided by the local authority under the Poor Law, for the shelter and relief of vagrants. Although a vagrant should obtain an order for admission to the casual ward from the relieving officer, this is rarely insisted on. The vagrant gives over his clothes to be disinfected, takes a bath, and is given a meal of cocoa, bread, or soup, before going to bed. After rest in a ward, some task of stone-breaking, wood-chopping, or digging is exacted in payment for the board. His personal belongings are then returned, and he is discharged. *See also* POOR LAW.

**Casuistry**, the application of the general rules of ethics or moral theology to particular cases. Originating in the West with the Greek sophists, the art is exemplified by many passages in Cicero's *De Officiis*, and with the development of the Christian moral teaching by the early mediæval philosophers and theologians it took on great importance. The Jesuit theologians, particularly Suarez, paid great attention to this side of theology, and were bitterly attacked by Pascal in the *Provincial Letters* for their alleged hairsplitting and tendency to emphasise detail at the expense of principle. In the Protestant bodies there has been little casuistical literature, the tendency having been to leave the solution of concrete moral problems to the conscience of the individual. Jeremy Taylor's *Doctor Dubitantium* is the most important example of an Anglican

## CATS



wild cat



blotched tabby



Persian cat



Siamese cat



narrow striped tabby



Manx cat

manual of casuistry See F H Bradley, *Ethical Studies*

**Casus Belli**, an alleged justifiable reason for making war, such as interference with a nation's sovereignty or independence, or action prejudicial to its vital interests Under post-War agreements, including those of the League Covenant and the Kellogg Pact, there is no admissible *casus belli* except invasion

**Cat**, a family of the Carnivora (*q v*) comprising lions, tigers, leopards, and many smaller species They are found in the temperate and tropical countries of both hemispheres, except Australasia and Madagascar

Generally, however, the name is used for the various domestic breeds, believed to be descended from two closely allied species, one inhabiting Europe, the other N Africa The latter was tamed by the ancient Egyptians, and was probably imported to Europe, where it mixed with the native wild cat, which is not uncommon in some parts of the Continent, and still survives in Scotland Both these species are marked with vertical black stripes, and this pattern may be seen on one of the commonest breeds, the striped or "mackerel tabby" Equally common in Europe is the marbled or "blotched tabby," in which the pattern is bolder and differently arranged

All the known breeds are traceable to one or the other of these two types, although the pattern in many cases has been eliminated by selective breeding The breeds differ principally in colour, length of coat and length of tail The chief colour variations are black, reddish yellow, grey, silver, and white, or a combination of these colours A combination of black and red produces the "tortoiseshell" variety. Curiously enough, "tortoiseshell" cats are almost always females, and red cats males, whereas the other breeds may be of either sex A breed well marked by its fawn colour with black head and extremities is the Siamese Long-haired cats are called

"Persians," but there is no reason to think they originated in Persia In Malayan cats the tail is often short and kinked, but this organ is reduced to a mere vestige in the breed known as the Manx cat, which is supposed to have come from the Isle of Man

Domestic cats have been transported all over the world, and in many countries have wandered into the bush and become established as wild animals

**Catacombs**, underground cemeteries This system of burial was used most widely by the Early Christians in Rome, where the rock was very suitable for excavation Catacombs were usually a series of narrow corridors, lined by tiers of graves in each wall The Christian catacombs are of value because of the style and extent of decoration on walls and graves, forming an important link in the history of art Pagan catacombs have been found, but they are very rare in comparison No doubt the Roman catacombs were useful refuges in times of acute persecution, but no definite housing arrangements have been discovered There are catacombs at Naples, Syracuse, Taormina, and Alexandria, in Malta, and at Kertch, Crimea Their study has been undertaken extensively only since the 19th cent

**Catalan**, a Romance language, closely akin to Provençal (*q v*), now spoken in the Pyrenées Orientales, Andorra, Majorca and Minorca, and some other localities Spanish Catalan may be considered as a genuine language, and it has a considerable literature, but most forms of Catalan are no more than a patois or dialect

**Catalectic** [*pron* KATŪLEK'tik], a line of verse of which the final foot is broken or incomplete; *e g.* the hexameter (*q v*), which ends with a trochee (or spondee) instead of a dactyl *Acatalectic*, conversely, applies to a verse consisting of unbroken and complete feet

**Catalepsy**, a rare and peculiar affection of the nervous system, often due to hysteria or sudden and violent mental

eraction It is initiated by loss of consciousness and the muscles become rigid but the limbs remain in any position in which they are placed Signs of life may be so obscured that the affected person is assumed dead The fit may last from a few minutes to several days in the latter case there are usually intervals of recovery The affection is more frequent in women than in men Ammonia should be held to the nostrils and continued friction applied to the body especially down the spine A mild electric current is sometimes a useful restorative

**Catalonia**, division of Spain formerly a province situated in the extreme N.E. and comprising Lérida Gerona Barcelona and Tarragona The surface is hilly and well wooded and is watered by the Ebro Segre Ter and other rivers Catalonia is the principal agricultural and manufacturing district of Spain and its products include cereals fruit wine cotton silk and woollens There are fair mineral deposits and coal lead and zinc are mined Coastal fisheries are valuable and there is considerable sheep rearing The principal towns are Barcelona Tarragona and Tortosa

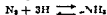
The province has a very strong local patriotism and its local language (Catalan) flourishes both in speech and literature Under the Spanish constitution of 1932 it has been granted a measure of independence in local government Area 12 400 sq m pop 3 000 000

**Catalysis** (*from* KATA LISIS) the name given to a chemical phenomenon which has been known from very early times though it has only recently been investigated closely and has now assumed the highest importance in chemical industry A *catalyst* is defined as a substance which accelerates a chemical reaction without itself suffering permanent change and the action of the catalyst is spoken of as *catalysis* The simplest case of this kind is that in which the catalyst though not permanently changed possesses chemical or

physical affinity for one of the substances concerned in the reaction A most active catalyst is very finely divided platinum and this is known to form very loose chemical compounds both with oxygen and hydrogen Hydrogen peroxide  $H_2O_2$  is an unstable substance and tends to decompose at ordinary temperatures into water ( $H_2O$ ) and oxygen In dilute solution the rate at which oxygen is thus formed at ordinary temperature is exceedingly small If however very finely divided platinum (platinum black) be added in minute amount to the liquid oxygen is rapidly evolved It is natural to suppose that the molecules of  $H_2O_2$  have ready access to the platinum surface and leave there an atom of oxygen the result being the formation of a very unstable oxide of platinum which readily decomposes The platinum collects the atoms so to speak and lets them go again in pairs

An important case is that of *autocatalysis* here the effect of the reaction is to produce a substance which serves as a catalyst and thereby increases the velocity of the reaction If we have for instance dry arsine ( $AsH_3$ ) sealed in a glass bulb it tends to decompose into metallic arsenic and hydrogen This reaction is at first very slow but the metallic arsenic deposited on the glass acts as a catalyst and the reaction then speeds up to a higher definite rate which is at once reproduced when fresh  $AsH_3$  is brought into the same bulb

Some reactions under a given set of conditions do not proceed to completion unless the resulting products are removed but come to a state of equilibrium Thus while ammonia decomposes into hydrogen and nitrogen by hydrogen and nitrogen also combine to give ammonia Such a reaction is represented thus



The proportions of the three bodies present at equilibrium depend on the temperature and pressure It is a fundamental law of catalysis that a

catalyst will accelerate the attainment of equilibrium, but will not affect the relative proportion in the equilibrium mixture

One of the earliest and most important observations made on catalysts is their susceptibility to "poisoning". Faraday found that the power of platinum to cause hydrogen and oxygen to combine was cancelled by minute amounts of carbon monoxide and hydrocyanic acid. It is found that those substances which act as poisons are those most strongly adsorbed on the surface of the catalyst (*see COLLOID CHEMISTRY*). By forming a film neutralising the activity of this surface the catalyst is prevented from acting.

**Catalysis, Industrial Applications of.**  
**Ammonia.** The Haber ammonia process is the most important recent development in catalytic chemistry. It was originally developed by Haber and Le Rossignol, an Englishman and a German who worked together in Germany. In this process a mixture of 3 parts by volume of nitrogen to 1 part of hydrogen is circulated under a pressure of from 100 to 1,000 atmospheres, according to the system, over a catalyst at a high temperature. A certain percentage of ammonia gas is formed, which is removed from the mixture of gases, generally by cooling them, the ammonia condensing to a liquid at the high pressure. The gases are circulated through the system by means of a pump, this must necessarily be done since the ammonia is only formed up to a certain percentage which depends upon the temperature. This percentage is higher the lower the temperature, but unfortunately the rate at which it is formed also depends upon the temperature and increases therewith. The percentage of ammonia formed also increases with the pressure, and the final choice of temperature and pressure will depend upon the cost of the plant for a given output.

**Fat-hardening.** This is the term given to a method by which liquid oils (cotton, linseed, whale) are converted

into solid fats by the action of hydrogen. It is a simple process, consisting in mixing the oil with finely divided metallic nickel, and subjecting it to the action of hydrogen at a temperature of 100–180°. The hydrogen is employed at a pressure of several atmospheres, and is bubbled through the hot oil. The oil requires to be purified in order to remove catalyst poisons, which in this case are mainly free fatty acid, and secondly albuminous substances, which are always present, as the oils are derived from plants and animals. The acids are removed by agitating with caustic soda, and the albuminous substances by means of Fuller's earth, which also removes colouring matter. The hardened fats are employed in the making of margarine, soap, and for other purposes.

**Sulphuric Acid.** The modern method of making sulphuric acid by the contact process depends upon the oxidation of sulphur dioxide,  $\text{SO}_2$ , by passing a mixture of it with air over a catalyst at a high temperature. Until recently the catalyst was always platinum, which is peculiarly susceptible to poisoning. It was employed in the form of a coating on asbestos from the earliest times in the development of this process, but a variety of supports are now used, among them magnesium sulphate (Epsom salts), which is soluble in water. This fact renders it easy to recover the platinum when, as always happens, it finally loses its activity. Recently, vanadium oxide has been used with success, great efforts have been made to avoid the use of platinum on account of its expense.

The sulphur trioxide ( $\text{SO}_3$ ), instantly forms sulphuric acid when brought into contact with water.

**Hydrogenation of Coal.** This process, about which much discussion has recently taken place, consists in subjecting coal to the action of hydrogen under heat and pressure. The pressure needs to be about 200 atmospheres and the temperature about 450° C. The coal is powdered and made into

a paste with about 40 per cent. of tar and oxides of iron cobalt and other metals are added which act as catalysts. Almost the whole of the coal is converted into liquid and gaseous substances the great bulk of the product being liquid hydrocarbons and pitch. Various processes and coals have given a great variety of results but roughly speaking 20-30 per cent. of the coal is obtained in the form of liquid hydrocarbons suitable for use in internal combustion engines and a further yield of 20 per cent. of heavier oils may be obtained. There is always a residue of unchanged solid substance. Much higher yields than these can be obtained under special conditions and a yield has been claimed of 60 per cent. of petrol as compared with the weight of the coal treated the cost being given as 7d per gallon. Since natural petrol now costs only about 3d per gallon there is no possibility of the process becoming competitive without a high protective duty. It is obvious that a more direct method of utilising coal to drive small vehicles is desirable and this is being sought in the use of coal-dust in the cylinders of the engine and of compressed coal-gas carried in cylinders.

**Methyl Alcohol** (wood spirit) is one of the most important industrial raw materials its formula  $\text{CH}_3\text{OH}$  suggests at once that it should be possible to make it from hydrogen and carbon monoxide (CO). This is now being accomplished successfully in a manner very similar to that employed in making ammonia. The catalysts used are oxides of copper zinc cadmium and chromium.

**Catamaran** a raft formed of three logs lashed together the central one being the longest and propelled by paddles or occasionally a sail. Used at Madras in Ceylon and in Brazil its special purpose is for crossing the surf in which any hollow boat would be broken up.

**Catania**, one of the most important cities in Sicily and an episcopal see especially famous for its Roman

remains. It is about 60 m S of Reggio on the E side of the island. Catania (in Roman times *Catana*) has been a city since the 4th cent B.C. has the third largest Roman amphitheatre known and has been occupied at different times by Greeks Romans Saracens and Normans. It has several times in the past suffered disastrously from the Etna volcano. Parts of the Cathedral date from the early 11th cent and the University from the 15th. Pop. 78,000.

**Cataphoresis** (*Kataphoresis*) see COLLOID CHEMISTRY ELECTROSMOSIS

**Catapult**, an engine for the projection of missiles by tensile power used by classical peoples in varied forms. The Roman catapults of which the designs were borrowed from those of Alexander consisted of the catapult proper a small machine like a cross bow mounted on a heavy frame for firing arrows and the ballista a large siege engine for throwing rocks and stones against the walls of a city.

**Cataract**, a condition in which there is a progressive clouding of the lens of the eye analogous to clear glass becoming frosted until finally the whole lens is opaque. As a result of the disease there is a dimness of vision ending finally in complete blindness in the affected eye or eyes. The formation of the cataract usually begins in the centre of the lens hence objects can still be seen in the early stages if looked at sideways. In the final stages provided the retina is healthy the patient can still appreciate small changes in the brightness of light and can detect the movement of large objects although quite unable to make out their detailed character. People with advanced cataract walk with their heads bent down so as to shield their eyes from light. This is a hopeful symptom indicating that the retina is still healthy and that there is a possibility of the sight being restored by an operation for the removal of the cataract.

Cataract may be congenital or it may result from injury. But what

ever the cause, the sight can often be restored, if the retina is still in a healthy state. The cure consists in surgical removal of the lens, followed by the provision of spectacles to take its place.

**Catarrh**, inflammation of any mucous membrane, the term is usually applied to that of the nose (*q v*), from whence it frequently spreads to the bronchi and air passages of the lungs. The ordinary "cold" is a form of catarrh, and is prevalent in damp, cold countries, especially where, as in Britain, the climate is changeable, or it may be produced by checked perspiration, as when a person moves from a hot room into a current of cold air. It may begin in the throat or chest and spread upwards, and must not be neglected. Where possible the affected person should remain in a warm room and encourage perspiration by hot drinks, etc. The vapour of various germicidal solutions may be inhaled, or, if the catarrh is in the throat or nose, a gargle or nasal douche is desirable, a salt-water solution of moderate strength forms an excellent nasal douche.

**Cat-bird**, so-called from its mewing note, is one of the mocking-birds of N America. For a similar reason the name is given in Australia to one of the bower-birds.

**Catechism** (*Oral Teaching*) has come to denote a summary of Christian doctrine by way of question and answer, intended mainly for the instruction of the young. Many Christian Churches have their own Catechisms. Some of the most famous are the Catechism of the Church of England, drawn up originally in the time of Edward VI, and modified until its final formulation in the Prayer Book of 1662, the Calvinist Catechisms authorised by the Westminster Assembly in 1647, viz the "Longer Catechism," and the "Shorter Catechism," an easier summary used very much by the Scottish Presbyterians, the "Penny Catechism," the Catechism of the Roman Catholic Church

in England, based on the "Catechism of the Council of Trent", and Luther's Larger and Smaller Catechisms.

**Catechol**, or pyrocatechol (*ortho*-dihydroxybenzene),  $C_6H_4(OH)_2$ , is a phenolic compound which was first obtained by the distillation of catechu, an extract used for tanning, which is obtained from certain Indian plants. Catechol is a colourless crystalline compound melting at  $104^\circ C$ . It can be obtained synthetically by the oxidation of *o*-hydroxybenzaldehyde with hydrogen peroxide. Catechol is employed medicinally as an antiseptic, and is of importance as the starting-point for the synthesis of adrenaline (*q v*).

**Catechu** [KATECHŌŌ'], see Catechol.  
**Catechumen** [KATIKŪ'MEN], name given to one who is being prepared for Christian baptism.

**Catering** :  
**FOR THE HOME**

This consists in procuring and supplying provisions. They may be (1) perishable commodities, which require renewing every day or two, (2) staple foods which can be ordered daily, weekly, or monthly according to size of storing space and perishability, (3) tinned or packed goods for cases of emergency, also such things as flavouring, dried fruit, gelatine, cleaning requisites, fruits for jams, etc., which should always be kept in the store cupboard. These can be ordered monthly or yearly.

**Buying Perishable Commodities**  
Menus should be planned ahead, for 2 or even 3 days, but supplies of fresh food should be bought on one day. A list can be made by looking through the selected recipes, and noting each item under the name of the respective tradesman. In deciding on the joint suitable for the occasion, the housewife wants to know what is the largest that can be obtained from a certain animal, what is the largest loin, for instance, that can be obtained from a lamb. The following list gives all this information.

A SKEW WEIGHT OF JOINTS AS CUT FROM  
T & CA CASE

## QUANTITIES REQUIRED PER H D FOR C D

<i>Beef</i>	
Aitchbone	9-10 lb.
Raron	24 lb.
Brisket	6-11 lb
Cheek	12-14 lb.
Cloot	8 lb
Flank (thick)	24 lb.
Flank (thin)	22 lb
Heart	5 lb
Kidney	2 lb
Neck	9 lb
Ribs	10-14 lb.
Round	9-14 lb.
Kump (t sk)	3 lb
Shin	7 lb
Silver-side	10-11 lb
Sirloin	4 lb.
Tail	3 lb
Tongue	8 lb

<i>Mutton</i>	
Heart	4-5 lb.
Leg	9 lb
Loin	7 lb
Neck (whole)	7 lb
Neck (ac ag end)	4 lb.
Neck (best end)	2-3 lb
Saddle	13 lb
Shoulder	8 lb

<i>Lamb</i>	
Leg	8 lb.
Loin	4 lb.
Neck	3 lb
Saddle	7-9 lb
Shoulder	4-5 lb.

<i>Calf</i>	
Butt	7-8 lb
Cutlet	2 lb
Feet	1 lb.
Flank	11 lb
Knuckle	4 lb
Liver	2-2½ lb
Loin	11 lb
Shoulder and blade bone	10-12 lb.
Sweetbreads (1 pair)	1½ lb

<i>Pork</i>	
Belly	7 lb.
Feet	2 lb
Ham	6-10 lb
Head	4-5 lb
Head and cheek	6-8 lb
Leg	7-8 lb
Loin—fore and hind	16 lb.

<i>Pig</i>	
Back and ribs	5-9 lb
Collar	7 lb.
Corner of gammon	4 lb
Flank	4 lb
Fore end	16-17 lb.
Forehock	10 lb
Gammon	13-14 lb.
Long back	9 lb.
Middle	22-24 lb.
Thick streaky	9 lb
Thin streaky	4 lb

<i>Fish Food</i>	
Meat or fish	4-8 oz (varying according to joint and no of persons)
Root vegetables (carrots & turnips potatoes)	6-10 oz.
Green vegetables	½ lb
Peas	0
Brussels sprouts	medium size
Cabbage	1 lb
Green peas (in pod)	1 lb
Spinach	1 lb
Tomatoes	1 lb
Broad bean (in pod)	1 lb
Fruit for st wing or p	1 lb
Milk	1 pt.
Butter	1 oz.
Cheese	1 oz.

<i>Staple Food</i>		
	Daily	Weekly approx.
Bread	4-6 oz.	2-3½ lb
Butter	½ oz.	1½ lb
Tea	2-4	2-4 oz.
Coffee	1 oz.	1-2 lb.
Sugar	3-4 oz	1½-2½ lb
Flour (pastry & cakes)	2-4 oz.	1-1½ lb.
Marmalade (for breakfast)	1-2 z.	1-1 lb.
Jam (one day)	—	1 lb
Milk	1 pt	2½-7 pints
Eggs (white or chocolate and pudding)	1	4-7

*Monthly Yearly or Seasonal Ordering*

Each month the store cupboard should be replenished with foods which can be quickly converted into attractive dishes in cases of emergency

*Cleaning requisites* such as scouring powders floor and other polishes and soda should be ordered monthly Soap on the other hand for economical use is best ordered yearly since it dries and hardens on keeping

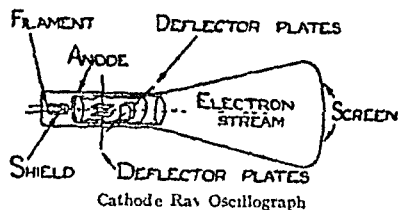
*Fruit for bottling* is best obtained direct from the growers as it should be bottled fresh and unbruised It is difficult to estimate the exact quantity required but supposing that it were used twice a week for six months of the year by a family of four each consuming ½ lb per time roughly 48 lb will be required for six months

*Fruit for jams* again is better and cheaper if obtained direct from the growers With regard to the quantity required supposing that the family in



tube This pressure is so low that only a fraction of the electrons in the beam strike gas molecules and ionise them, but the resulting positive charge tends to draw the electrons forming the beam together The beam is focused on to the screen by adjusting the filament current, the shield voltage, and the main voltage The beam of electrons is deflected in either or both directions by applying an electrostatic voltage to the plates, the deflection being closely proportional to the applied voltage, and instantaneous The apparatus is unique, having no natural period of its own, and hence it exhibits no resonance at any frequency

The apparatus will measure any rapidly varying quantity which can be reduced to an electrical effect If it is necessary to determine the variation



Cathode Ray Oscillograph

with time of a certain quantity, one pair of plates is connected to a source of potential which varies in a constant manner with time, by means of certain devices it is possible to arrange that the spot shall move in one direction across the screen at a uniform speed, and return to zero with great rapidity The other pair of plates are then connected to the quantity to be measured, and the spot traces the curve of its variation with time In television reception the movement of the spot across the screen in one direction is coupled with a step by step movement at right angles, so that the whole screen is traversed by the spot 16 times per second A large number of different methods have been proposed for modulating the intensity of the spot in each position See also TELEVISION.

**Cathode Rays**, see ATOM, CONDUCTION OF ELECTRICITY THROUGH GASES.

**Catholic Apostolic Church**, name given to a Christian sect founded in 1832 by Edward Irving, previously a Scottish Presbyterian It is based on an attempt to restore the supposed doctrine and discipline of the early Church, and has an elaborate ritual and hierarchy, consisting originally of twelve apostles, twelve prophets, 12 evangelists, 12 pastors, and 7 deacons to administer financial affairs Each congregation has its "Angel," who acts as its pastor, and 24 priests divided into 4 orders, each congregation being separately a replica of the central organisation

**Catholic Church**, primarily, the Christian Church as a whole, or that part or those parts of it which claim to have kept their doctrine and ministerial succession unchanged since the Apostles In this sense members of the E Orthodox, Anglican, and some other Churches claim to be Catholic More often the name is applied to the Roman Catholic Church (*qv*), which claims to be the only true Catholic Church The word Catholic (*lit* "universal") is sometimes also used to denote a person who is opposed to the Protestant doctrine of private judgment in religion

**Catholic Emancipation**, the granting of political rights to Roman Catholics in Great Britain in 1829. Since the Reformation, Roman Catholics in the United Kingdom had suffered under many restrictions At the end of the 18th cent the worst of these restrictions were removed, but in Ireland they still remained In 1824 a vigorous agitation for reform was conducted by O'Connell (*qv*), who formed the Roman Catholic Association In 1829 the Catholic Emancipation Bill was passed, sponsored by a Tory Government, members of which had previously opposed this policy It gave political rights to Roman Catholics, enabling them to hold all public offices but that of Lord Chancellor

**Catholic Epistles**, name given to the

New Testament Epistles of Peter James John and Jude because they seem to have been addressed to the whole Church

**Catiline** Lucius Sergius (c 108-62 B.C.) Roman conspirator Governor of Africa 67-66 B.C. Failed to be elected as Consul in 65 B.C. and organised a plot to seize power but was defeated and killed 62 B.C. Chiefly remembered from Cicero's speech *In Catilinam* which attacked him in the Senate

**Cations** (from KATIONS) the ions in a solution of an electrolyte which are positively charged and which therefore when a current is passed through the solution appear at the cathode or negative electrode See also ELECTRO-CHEMISTRY

**Catkin** the flowers of willow (pussy palm) poplar and a number of other trees arranged in spikes each consisting of flowers of one sex articulated to the stem bearing them

**Cato Marcus Porcius** (234-149 B.C.) known as The Censor Roman statesman and writer became Consul in 190 B.C. took part in the defeat of Hannibal at Zama held command in Sardinia and Spain and in 191 B.C. assisted the Greeks in overthrowing Antiochus III at Thermopylae Bitterly hostile to the new Greek culture Cato promoted measures against luxury instigated the prosecution of Scipio Africanus for corruption and reformed the Senate He urged the final war against Carthage with the declaration Carthage must be destroyed A pioneer in Latin prose he was the author of *De Re Rustica* (On Agriculture) and a Roman history now lost

**Cato Marcus Porcius**, the Younger (c 98-48 B.C.) Roman administrator philosopher staunch republican and the bitter enemy of Caesar In 58 B.C. as tribune he subdued Ptolemy King of Cyprus became quaestor on his return to Rome and strove to suppress bribery He joined Pompey against Caesar in the Civil War and after Pompey's defeat at Pharsalus marched

through the Libyan desert to Utica where he stabbed himself to avoid capture by Caesar Cato was idealised by the Stoic school His life is the theme of Addison's tragedy *Cato*

**Cato Street Conspiracy** a plot formed by Thistlewood and others early in 1800 to assassinate the Cabinet Ministers while they were at a dinner The conspirators met in a loft in Cato Street London where they were captured five being subsequently hanged

**Cat's Eye** see QUARTZ

**Catskill Mountains**, a group in the State of New York a favourite holiday resort The Catskills are of moderate height (Hunter Mountain 4055 ft) and contain some very beautiful scenery The State has acquired a forest reserve (c 200 sq m) and the district is considered very healthy

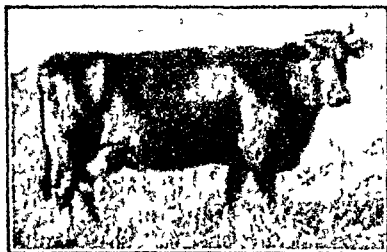
**Cattaro** (or Kotor) port of Yugoslavia some 10 m N.W. of Cetinje Cattaro has a good natural harbour and is well fortified but lacks the communications to make it an important naval centre The principal industry is lace making Cattaro was known about the 2nd cent B.C. and has been successively held by Romans Saracens Bulgarians and Austrians Pop 5000

**Cattegat** (or Kattegat) sound lying N and S between Sweden and Denmark and connecting the Skagerrak through the Sound the Great and Little Belts with the Baltic Sea Length 10 m breadth from 40 to 88 m

**Cattle** a group of ruminants of large size comprising buffaloes bisons yaks and the domesticated breeds and a few wild species related to them Domesticated cattle are referable to two principal types the humped cattle sometimes called zebu and regarded as sacred in India and the European breeds

The former named from the presence of a hump of fat on the shoulder are particularly valuable in the tropics from their power to withstand the heat and other conditions of which European cattle are intolerant Their origin is obscure

The European breeds are no doubt descended from the extinct aurochs (*q v*), which, except for its superior size, was similar to the half-wild white



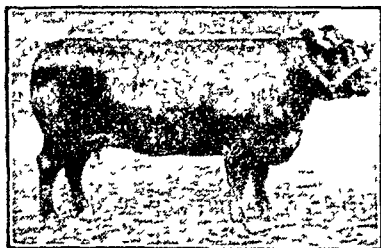
Shorthorn Jersey Cow

Park cattle, now mostly moved to Whipsnade from Chillingham, Chartley, and elsewhere in England

In addition to the zebu, there is in India a domesticated breed, known as the gayal, which is descended from a wild species, the gaur or tsain, sometimes wrongly called "the bison". The gaur is a formidable animal, distinguished by high arched withers and white "stockings". In Burma there is a smaller related species, the banteng which has been domesticated in Java (see BISON, BUFFALO, YAK, ZEBU)

#### British Domesticated Cattle

The chief varieties are as follows  
**Shorthorn** Originating in the Valley of the Tees and surrounding district, the Shorthorn has spread to every part



Sussex Cow

of the world and is probably the most numerous pure variety now in existence. With milk yields to its credit surpassed by no other variety, yet

possessing a well-marked tendency to produce prime beef at an early age, the breed justly enjoys a reputation for both milk and meat. Of late years the two functions of the breed have been separated in this country, the milking strains being registered by the Dairy Shorthorn Association while the beef variety continues to be handled by the older Shorthorn Society. In colour Shorthorns are red, red and white, and a roan or a combination of those shades. Formerly, pure white was regarded with disfavour, but many of the most prominent beef Shorthorn prize winners have lately been of that colour. In the Dairy Shorthorn a rich red is much prized.

**Sussex**, a beef-producing animal, believed to be the oldest breed in this



British Friesian Cow

country, has the ruddy-red colour common centuries ago in the S of England. They graze well on average herbage and calve in the open; they are never milked by hand, but given a second calf to suckle if they produce excess of milk. They are fattened on grass with or without cake before selling, and mature early.

**British Friesian**, black-and-white, with small curved horns, a rather long head, and great width at the pin bones, the heaviest-yielding breed. The milk varies, in some cases being very inferior.

The breed was imported from Holland, and has been bred for generations for milk. The *Friesian Herd Book* was begun in 1870, since when much has been done to improve the breed by careful selection through keeping of

milk records and inspection of animals. The British Friesian Society was formed in 1909.

*Galloway* probably arose from the very old Middle Horn breed from the same stock as the Highland cattle. The type was fairly distinct by 1750 when the horned varieties had been eliminated and in the early 19th cent. the breed was at its best along the Solway borders where a hardy race developed with thick hides and much protective hair. They are brownish black with short wide head level neck and squarish body on short legs and good feet. The Galloway is much valued for beef but milk production is only fair on the whole though the butterfat content is high.

*Hisland*. The origin of this beef



Hereford Bull

breed is unknown but it is certainly fairly old. It was much improved by selection c. 1800. A modern Highland bull has curving horns set wide apart on a broad brow covered with straight hair, bright full eyes, short strong muzzle with strong lower jaw. The neck scarcely rises and is free from loose skin below. The quarters are long, the flanks and thighs deep and the tail reaches the ground. The lighter colours are most favoured. The Highland Cattle Society was founded in 1894.

*Hereford*, one of the most important of the world's beef cattle. It originated in Herefordshire and is now bred over the whole of the Severn area. The animal is large and heavier than the Aberdeen Angus, deep red in

colour with white head, tail and underline. The head is short and broad and the neck short. The body well proportioned and well fleshed with



White Friesian

firm smooth flesh. The skin is thick and soft to the touch. The breed is remarkably hardy and healthy and is reared on the poorer pastures throughout Australia, the Argentine and the United States.

*Aberdeen Angus* bred for beef. Much attention was given to the breed by many famous 18th-cent. breeders who did most valuable work in selecting and blending towards a rounded conformation with neat full quarters and smoothly filled in and well-covered shoulder, ribs and quarters. The breed is valued all over the world and reared in specially large numbers in the United States and Argentina.



Lincoln Red

*Lincoln Red*, a variety of the short horn from the lands surrounding the Wash, is now distributed generally over E. England. It has a larger

frame, is longer and less compact than the Shorthorn, and uniformly deep red in colour. There are good beef and dual-purpose strains. The beef is rather large and coarse, but is in considerable demand. The milk yield is some 800 gallons a year.

*Ayrshire* The origin of the breed is disputed, but there is evidence that the parents were brought from Holland in the 16th and 17th cents, since when there has been some crossing with Highland and other breeds. The breed is now classed as one of the leading milk varieties. The modern Ayrshire has wide shoulder depth and rib spread, and a capacious udder, with large teats. The milk is rich in casein, and therefore especially suitable for cheese.

*Jersey* A small, beautiful, docile animal weighing only c 800 lb. The colour is very variable, usually a shade of fawn, brown, or grey, and the skin of a remarkable soft texture. The breed is probably derived from the small cattle of Normandy and Brittany. The milk is very rich, containing more butterfat than any other breed, and the fat globules are large and even in size, so that the cream churns easily and with little waste. The cows often milk to a very old age, but the cattle have very little value in the meat market.

*Guernsey* A small cow, but larger than the Jersey, usually fawn coloured, with or without white markings, sometimes with black markings and brindle. Believed to be derived from crosses between two breeds introduced into Guernsey from France in the 10th or 11th cent by monks. Guernseys produce very rich milk of a deep colour with high butterfat content. They are often milked 3 times a day, and 1000-gallon cows are fairly numerous.

*Kerry* An ancient breed, widely distributed, believed to have survived from the native cattle of Ireland. The modern Kerry is black, with a long head and prominent eye, widely set, slender horns, slender body with light

shoulders and lean thighs on long slender legs, and well-developed udder. The breed is remarkably hardy, with an average yield of 600 gallons, and butterfat content of 4-4½ per cent.

*Red Poll* A dual-purpose breed derived from the Norfolk red-horned variety and the Suffolk polls, with possibly some N Devon and shorthorn blood. The cattle are blood-red, with cream-coloured nose, and may have white udder and tip of the tail.

*Devon* A very old breed of cattle possibly derived from the red cattle brought to England in the 6th cent. by the Anglo-Saxons. Medium-sized animals, of deep bright red, often with dappled markings, hardy and healthy, giving good beef and also bred for milk.

*S Devon* A remarkably large breed, the cows often weighing over 15 cwt and the bulls reaching 1½ tons. The origin is not known. The beef is good, though their large size is a disadvantage, and the milk yield is satisfactory, with a butterfat content above the average. The breed has been exported to S Africa, where it is highly successful.

*Calving* usually takes place from Jan to April, the period of gestation being just over 9 months. Cows in calf require careful feeding, on moderate quantities of turnips, barley mashes, and oil-cake, the latter being especially valuable for its laxative properties. Calving usually requires assistance from a skilled cattleman or shepherd.

*Milking* needs greater care and skill than is generally realised. The udder should be capacious and nearly spherical, with moderate-sized, equally spaced teats, which do not taper. Cows usually give milk for 10 months after calving, but this is very variable. Milking is done 2 or 3 times a day, and must be regular. Milking machines have been introduced which are run by an exhaust pump and are highly successful in obtaining the whole of the milk and butterfat.

*Feeding* practices vary greatly according to the breed of cattle and whether they are kept for dairying or

meat They are fed twice daily on roots turnips or swedes and 3 times with bean pea rice maize or cotton cake Much hay and straw must be given

**Housing** The arrangement of cow houses and dairies is now strictly regulated in the interests of public health On a farm on which cattle are only bred and reared the necessary stabling is simply a protection for cows and calves in severe weather and the only essentials are adequate space and the provision of sufficient ventilation with no draughts

**Equipment for Cattle Houses** Troughs are now frequently made of concrete or turnip troughs of wood Straw racks are usually of iron of squared form standing on legs and rodded at the sides to keep in the straw which is drawn from the top Water troughs are extremely important as a constant supply of clean water is essential

**Hammels** are sheds communicating with an open court by a large open door Two oxen require a hammel 12 x 10 ft with a court 14 x 10 ft A straw rack should be fastened against the inner wall of the shed and a water trough stand at the corner of the court

**Cattle boxes** are sometimes preferred to hammels especially for fattening which is then more rapid but the increase in labour and the additional litter required are costly

**Stalls** should be wide enough for the cow to lie down in comfort and to be milked easily and long enough to allow for a manger of 2 ft the length of the cow a gutter 1 foot broad and a wide passage

**Mangers** are usually placed on a level with the floor of byres but this is highly objectionable because of the strain on the feeding animal The manger should always be raised 2 ft from the ground and made wide enough for the comfort of horned cattle

**Flooring of Byres** should be of concrete indented to prevent slipping

but where the cattle will kneel on their forelegs beaten earth should be used The gutter running the length of the byre should be flagged and slightly broader than an ordinary square mouthed shovel to facilitate rapid clearing out

**Cattle-rearing** see AGRICULTURE

**Catullus, Gaius Valerius** (84?-64 B.C.) Roman poet wrote the finest lyrics in Latin literature They are notable for their sincerity for their metre (Catullus is the master of the hendecasyllabic line) and for their perfect originality They were for the most part inspired by Lesbia a famous beauty of the time and the poem on her sparrow is probably the best known of Catullus's works Of his other works his scurrilous epigrams especially those attacking Caesar are the best

**Caucasian Area, N** district of the USSR immediately E of the Sea of Azov and the Black Sea Except in the S where the ground rises towards the Caucasus Mountains the district is flat and fertile and is notable for its agriculture—wheat and other cereals poultry wine market gardening and tobacco Under the Soviet régime manufactures are being developed and include naphtha cement textiles milling and foodstuffs There is some fishing but sheep-rearing once of great importance has declined The chief towns are Rostov-on-Don Krasnodar and Grozny Area 93 500 sq m pop 8 000 000

**Cauchy Augustin Louis, Baron** (1789-1857) French mathematician He studied at the École Polytechnique lectured at Turin university and was tutor to the grandson of Charles X The results of his valuable researches on series determinants the calculus Taylor's theorem the continuity of matter and the wave theory were published in treatises and articles

**Caucus** the system under which voters are required to vote with their party regardless of their individual views upon specific questions or candidates in America merely a meeting

of party officials with the object of appointing candidates or delegates

**Caudine Forks**, pass in the mountains of Samnium (Italy) between Naples and Benevento, the Romans were heavily defeated here by the Samnites in the 4th cent B.C.

**Cauliflower**, a variety of cabbage having a large inflorescence with thickened, fleshy stems and tiny flower buds, it should be cut when the latter are fully formed but unopened. It requires very rich, fine soil and abundant water, and much attention is necessary. A succession of heads is obtainable from May to Nov if suitable varieties are chosen and the crop well managed. Cauliflowers should be cut early while the dew is still on them. They are best eaten at once, but if keeping is necessary, they should be dug up, and hung head downwards in a cool dark place, with the earth still attached to their roots, and gently syringed every evening.

**Caustic Soda**, the popular name for sodium hydroxide, NaOH (see ALKALI, SODIUM).

**Cauvery**, Indian river rising in the W Ghats, and flowing E across Mysore and the Carnatic into the Bay of Bengal. Along its course are a number of irrigation dams of which the most notable is that across the Coleroon, 2250 ft in length, a total area of about a million acres is drained. The Cauvery falls produce electric power. The river, which is not navigable, is sacred in Hindu eyes. Length 415 m.

**Cavalcanti, Guido** (c. 1245-1300), Italian poet, a friend of Dante and leader of the Ghibellines. He is best known for his love sonnets and songs.

**Cavallini, Pietro** (1259?-1344), Italian artist, renowned both for mosaic-work and painting. He worked under Giotto. A *Crucifixion* in the N transept of the Lower Church at Assisi is attributed to him, as are some frescoes recently discovered in the church of Santa Cecilia in the Trastevere at Rome.

**Cavalry**, general term for mounted

soldiers. Horse-soldiers have been used in Asia since very early times and were as common there as infantry in Europe. Cavalry was first introduced into the West by Philip of Macedon and Alexander the Great, and was brilliantly exploited by Hannibal, the Carthaginian. The Roman cavalry were always weak, but an impetus was given by the victories of the Gothic horsemen in the 4th and 5th cents. As war came to be carried on by a privileged noble class, the mounted knight became a common figure from the days of Charlemagne onwards. Cavalry of this kind was used with little discipline but with considerable success in the Crusades. Plate-armour reduced the speed, dash, and mobility, which had constituted the decisive advantages of the horsemen, and by Bannockburn (1314) and Crécy (1346), the infantry, and especially the bowmen, were once more in the ascendant.

Lightened of their heavy armour and armed with light arquebuses, the cavalry made a brilliant return c. 1500, under Charles VIII. Their real success, however, came in the 17th cent, when the procedure, invented by Gustavus Adolphus, was to fire with pistols and then charge with the sword. This return to shock-tactics culminated c. 1750, under Frederick the Great, when all armour and firearms were set aside in the interests of speed, and the sword was the only weapon used.

In Napoleonic times, cavalry fell into a decline, in which it remained, despite a few successes with mounted infantry in the American Civil War (1861-5), until the Franco-German struggle of 1870. At Sedan, the slaughter of the Chasseurs d'Afrique proved that the breech-loading rifle had ended straightforward cavalry charges for ever. Thenceforward, the arm was to be used for strategy alone, although it scored a few brilliant successes in guerrilla colonial wars such as the Boer War. Despite the lessons learnt in the 19th cent, about

a million horsemen were assembled in the first years of the World War chiefly by the Russians and Austrians only to be mown down by machine-guns and rifle fire. In 1914 however cavalry was used several times in effectually as a protective screen and it was not until 1918 that the old theory that a cavalry charge should follow up a victory was finally abandoned. But in Palestine and Mesopotamia in open country and against a demoralised enemy Allenby waged a brilliantly successful cavalry campaign which ultimately defeated the Turks. About the middle of the War armoured car sections were attached to the cavalry proving of great value though another step towards the inevitable mechanisation of the mobile arm. The future probably holds an adaptation to cavalry tactics of fast tanks and armoured cars while the reconnoitring function will be carried out mainly from the air a form of campaign already foreshadowed by actions on the N.W. Frontier of India.

A British cavalry regiment is composed of 4 squadrons of 2 troops each. **Cavan**, an inland county (730 sq. m.) Irish Free State bounded S.W. by Longford and N.E. by Monaghan. The N.W. is mountainous but the remainder is undulating or low lying. Agriculture is carried on though there is a considerable need of drainage. Oats and potatoes are produced and a fair number of cattle raised. There are no manufactures of importance save a little bleaching and whisky distilling. Cavan is the county town. It has a small linen trade but is mainly notable for its grammar school. Pop. (county) 87,500 (town) 3000.

**Cave George 1st Earl** (1806-1892) English lawyer and Lord Chancellor barrister 1880 Conservative M.P. 1906 knighted and Solicitor-General 1915 Home Secretary 1916 Lord Chancellor 192 and 194-8 Chancellor of Oxford University 1900-8 Created Viscount 1918 and Earl 1928 dying (heartless) the next day.

**Caveat** (Lat. let him beware) a formal notice by a party interested to the appropriate officer used to prevent the performance of a judicial or ministerial act until the rights of the party interested have been properly determined. It may be entered to stay the probate of a will letters of administration a licence of marriage the institution of a cleric to a benefice or the grant of a patent etc.

**Caveat Emptor** (Lat. let the buyer beware) legal maxim meaning that a purchaser must take all reasonable precautions in regard to the article or property purchased and if he fails to do so cannot repudiate the sale on the ground that he has not obtained what he expected. By statute however certain conditions are implied in a contract for sale of goods that the seller has a right to sell the goods that the bulk shall correspond to sample that the goods shall correspond to description and that they shall be reasonably fit for the buyer's purpose if the purpose was made known to the seller. Thus the buyer's position has been somewhat eased.

**Cavell, Edith Louisa** (1865-1915) English nurse was at the outbreak of the World War matron of a hospital in Brussels. From Nov. 1914 up to Aug. 1915 she secretly aided some 200 Allied soldiers to escape from hospitals and internment camps to the Dutch frontier. For this she was arrested (Aug. 5) imprisoned court-martialled and executed (Oct. 12) in spite of attempts to obtain a reprieve. Her statue which stands near Trafalgar Square London bears her famous words— Patriotism is not enough.

**Cavendish, George** (1500-1562?) was a close friend of Cardinal Wolsey. His biography *The Life and Death of Thomas Wolsey* first appeared in 1641 but was not printed in full till 1861. It is of importance as being a contemporary source of information.

**Cavendish, Henry** (1731-1810) English chemist and physicist who made researches into the nature of gases.



He is chiefly remembered for having discovered the chemical composition of water, but he also made many interesting discoveries in electrical phenomena. His papers were not fully published for many years after his death, when it was found that he had anticipated several modern theories. The Cavendish Laboratory, Cambridge, is named after him.

**Cavendish, Thomas** (? 1555-1592), English navigator, chiefly distinguished as being the third man to sail round the world, which he did by way of Magellan's Strait (1586-88).

**Caviare**, the roe or eggs of the sturgeon or sterlet, preserved in brine. There are two principal kinds, Astrakhan and Orsova, the former being the more expensive of the two. It is prepared in Russia, Norway, Germany, and America, and is used chiefly for hors d'œuvres as croustades, or savouries as bouchées, patties, and sandwiches.

**Cavour, Camillo Benso, Count** (1810-1861), Italian statesman, entered politics 1848 after being a farmer in Piedmont, was in turn Minister of Agriculture, Commerce, Marine, and Finance, and Premier 1852. He led the movement for the unification of Italy and its freedom from Austria, signed treaty with England and France, 1855, and thereupon sent a detachment to join them in the Crimea. After an unsatisfactory Austrian treaty, 1860, Cavour encouraged Garibaldi (*qv*) and his revolutionaries, who defeated Naples, and handed the conquests to King Victor Emmanuel. He became first minister of the kingdom of Italy.

**Cavy**, tailless S American rodent (*qv*) akin to the Agouti, and sometimes called guinea-pig, a corruption of guiana-pig, from the supposed origin of the domesticated breeds. Cavy are favourite cage animals in England and other countries, and may be smooth or rough-coated, the latter variety having the hair growing forwards in patches on different parts of the body.

**Cawdor**, Scottish village in Nairnshire, a few m SW of Nairn. Famous for its castle at which Shakespeare's

*Macbeth* places the murder of King Duncan, though it was not in fact built until the 15th century.

**Cawnpore**, town and district in the United Provinces, India, lying on the Ganges, a notable railway centre and military station, with large manufactures of leather goods, cotton, and woollens. It is famous for the massacre of Cawnpore in the Indian Mutiny, when several hundred Europeans were murdered by order of Nana Sahib. The district is situated between the Ganges and the Jumna Rs., and is very fertile, forming a part of the Doab Area, 2350 sq m., pop district, 1,150,000, town, 243,755.

**Caxton, William** (c 1422-1491), the first English printer, was also a translator and man of letters of great ability. On the Continent, where he travelled widely, he learned the art of printing and set up his first press in Bruges (1474). In 1476, in the almonry of Westminster at the sign of the Red Pale, the first piece of English printing, an *Indulgence*, was published by him. The first book bearing a date was Caxton's version of Rivers' translation of *The Dictes or sayenges of the philosophers* (Nov 18, 1477). Thereafter he printed many service-books and romances of chivalry translated by him from the French. Chaucer's, Gower's, and Malory's works were also published by Caxton. He was succeeded by Wynkyn de Worde.

**Cayenne**, capital of French Guiana (S America). It is a seaport, with an export trade in gold, hides, phosphates, and cacao. The harbour accommodates vessels of shallow draught only. Cayenne, the seat of government, was once a penal settlement. Pop 13,500.

**Cayman Islands**, three W Indian islands under the administration of Jamaica. The islands are named respectively Cayman Brac, Grand Cayman, and Little Cayman. Turtles, coconuts, phosphates, and timber are the chief products. Pop c 6000.

**Cazales**, on the S coast of Sardinia, was in ancient times the leading city of the island. Cazales is famous for

valuable and extensive Roman remains including an amphitheatre baths houses and several tombs It is believed to date back to the Carthaginians

**Ceará**, State on the N coast of Brazil bounded N by the Atlantic E by Rio Grande do Norte W by Piauí and S by Pernambuco Much of it is occupied by the N E end of the Brazilian plateau and the remainder is a barren coastal strip The main products are agricultural and include sugar cotton rubber coffee and fruit though crops are frequently devastated by drought The only river of any note is the Jaguaribe The capital is Fortaleza or Ceará Area 40 240 sq m pop 1 620 000

**Cebu** island of the Philippines N of Mindanao Native products are considerable copra tobacco and sugar being the chief Cebu is also the name of the capital and port of entry on the E coast Area of island 1690 sq m pop 856 000 (town) 70 000

**Cecil**, English family descended from William Cecil (b 16<sup>th</sup>) minister to Queen Elizabeth created Lord Burghley 1571 One branch of the family comes through his son Thomas 1st Earl of Exeter the other the Hatfield line through a younger son Robert Cecil created Earl of Salisbury 1605 The 10th Earl in the elder line is the subject of Tennyson's romance *The Earl of Burleigh* See BURGHLEY WILLIAM CECIL SALISBURY ROBERT 3RD MARQUESS OF SALISBURY ROBERT CECIL 1ST EARL OF CECIL LORD HUGH CECIL OF CHELWOOD 1ST VISCOUNT

**Cecil Lord Hugh Richard Heathcote** (b 1869) English politician son of 3rd Marquess of Salisbury M P for Greenwich 1895-1906 and for Oxford University from 1910 He is noted for his activity in Church matters being a member of the Church Assembly and a keen supporter of the Revised Prayer Book measure when it came before the House of Commons in 1928 He has always been an independent Conservative resisting

Chamberlain's tariff reform proposals and the Liberal Parliament Act 1911 with equal vigour

**Cecilia**, St suffered martyrdom in Sicily c A D 180 She is the patron saint of music and of blind people Feast Nov 2.

**Cecil of Chelwood**, 1st Viscount (Edgar Algernon Robert) (b 1864) 3rd son of the 3rd Marquess of Salisbury was called to the Bar in 1887 became a K C in 1900 and joined the Conservative Party being elected M P for Marylebone in 1906 M P for Hitchin 1911 23 In 1918 he introduced the Bill enabling women to sit in Parliament He helped to draft the Covenant of the League of Nations and has taken a great interest in its affairs especially on the question of Disarmament which he strongly upholds Author of *The Way of Peace* (1923)

**Cecrops** legendary Egyptian founder of Athens (c 1500 B C) and traditional fountain of its laws religion and customs

**Cedar** A tree of the pine family with a fragrant durable wood it burns with a sweet incense like scent The word cedar applied to timber covers 60 to 70 woods

**Cedilla** [*pron* SEDILLO] a mark written or printed under the letter C thus Ç as in French to indicate that it is to be pronounced like S when because of its following vowel it would normally be pronounced like A

**Celandine** [*pron* SELANDIN] The Lesser Celandine is a small plant belonging to the buttercup family having triangular fleshy leaves and bright yellow flowers produced in great number on sunny banks in early spring The roots are tuberous The greater Celandine is a cottage garden plant but is also frequently found wild in the neighbourhood of houses The feathery leaves are a beautiful pale blue green and when torn exude an orange-coloured juice The flowers are orange yellow with five petals and a large number of stamens the plant belongs to the poppy family

**Celebes**, island of the Dutch E Indies, lying immediately E of Borneo, and separated from it by the Strait of Macassar. The island is of a peculiar shape, being made up of 4 large peninsulas, 2 extending almost due S, and separated by the Gulf of Boni, a third stretching E N E, and separated from the fourth, which extends first N and then E, by the great Gulf of Tomini. The coast-line is thus of great length, and has a number of good natural harbours, though reefs are dangerous. The whole island is mountainous, and in places volcanic. Mounts Bonthain and Koruwe are both above 10,000 ft. The rivers, of which the Sandarg is the largest, are not important. Plants and trees are luxuriant and varied, and native animals include the baboon, dwarf bison, and crocodile. Agriculture, especially near the coasts, is extensive, and the main products are copper, rubber, copra, and nutmegs. Fishing for mother of pearl is considerable. Mineral deposits are not large, but gold, nickel, and iron are mined. There are several different native tribes, with all of whom the Dutch have working agreements for trade and government. The chief town is Macassar, and others of less note are Menado, Bonthain, and Donggala. Area, 78,000 sq m, pop 3,400,000.

**Celery**, an umbelliferous biennial plant. The blanched and fleshy stalks of the inner leaves are used as a vegetable and salad. Seed is sown out of doors in April, on a rich, light soil, and the seedlings pricked out when large enough. The plants are then bedded out in trenches, with plenty of horse manure and water, and, when fully grown, are earthed up. This process requires care and experience. The crop may be cut about seven weeks after the blanching process is begun.

**Celery Seed**, see SPICES AND CONDIMENT

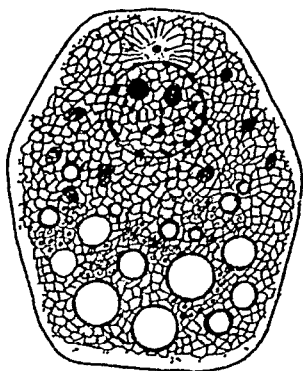
**Celestial Horizon**, see OBSERVATORIES

**Celestial Meridian**, see OBSERVATORIES

**Celestial Sphere**, see OBSERVATORIES

**Celestine**, name of five Popes. Celestine I (422-432) is said to have sent Palladius as a missionary to Ireland. St Celestine V (1295), unexpectedly chosen Pope while living as a hermit, a man of saintly life but temperamentally unsuited to the tiara, resigned after a reign of a few months.

**Cell**, biologically, the fundamentally similar unit of structure of plants and



a typical undifferentiated cell with resting nucleus

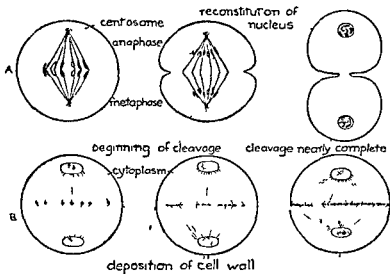
animals. It is composed of a gelatinous substance called protoplasm or cytoplasm which is regarded as the physical basis of life.

A typical cell, sometimes called a protoplast, consists of a mass of viscous, translucent, semi-fluid material, the *cytoplasm*, and one or more denser bodies, the nuclei, embedded in it. Food granules and other small bodies are often included in the cytoplasm, which, with the nucleus, constitutes the protoplasm. The cytoplasm of young cells is practically continuous, but in older plant cells there are often hollow cavities, or vacuoles, containing cell sap. These vacuoles may coalesce as the cell grows, and in an old-plant cell one large vacuole may fill the central cavity, the nucleus lying in the cytoplasm lining the cell wall.

The nucleus of higher plants and animals generally in its resting stage is a rounded body having a definite membrane enclosing karyolymph the nuclear sap. Embedded in this is a network of granules of a substance called chromatin connected by fine linen threads. Cells of some fungi and protozoa have very few chromatin granules instead of the network found in the higher cells. Although chromatin is scattered within their cells in

plays a very important part in cell division.

Cell division begins by simple and direct separation of the nucleus into two halves which is called amitosis but the most usual form of nuclear division is a complicated process called mitosis or karyokinesis. Mitosis in the body-cells concerned with growth differs from that of the reproductive cells. In the body or somatic cells the nuclear network of linen and



A Formation of the cell wall by deposition

B Separation of cells during cleavage

bacteria certain of the blue-green algae and some protozoa no organized nucleus can with certainty be distinguished.

The nucleus plays a very important part in the activities of typical cells. In some unknown way the nucleus controls the metabolism, growth and reproduction of the cell. Cells from which the nucleus has been removed may continue to live as long as a month but are unable either to increase the amount of cytoplasm or to divide and such cells ultimately die. The nucleus

chromatin loses its characteristic appearance and usually forms a long tangled thread the *spindle*. During this process contraction takes place and the membrane begins to disappear. The spindle loosens and becomes divided into a number of short segments the chromosomes each of which splits longitudinally through the middle. During the segmentation into chromosomes at opposite poles of the nucleus very fine threads radiate from the cytoplasm forming small starry structures the asters. Their

radiations extend across the nuclear area and meet, forming a continuous spindle-shaped structure extending

are formed During the telophase the chromosomes gradually form the characteristic reticulum or network, which is in many cases produced by the contacts of the chromosomes with one another, and their cohesion at the points of contact when separation begins By some reaction between the chromosomes and cytoplasm, minute drops of clear fluid appear between the chromosomes, and between them and the cytoplasm.

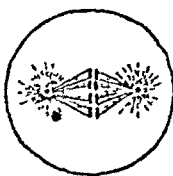
The latter drops are organised to form the nuclear membrane, while the inner ones constitute the nuclear sap.

One of the most striking features of mitosis is the revelation of the constancy of the chromosome number in any given species of plant and animal.

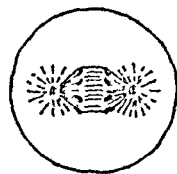
All the somatic cells of any individual contain the same number of chromosomes. In some ferns it is 256, in garden peas, 14, in pigeons, 16, and in white women, 48. Some observers record 48 in white men, but others have found only 47. Moreover, the shapes of the chromosomes are constant throughout the species. V-, U-, J-shaped, rod-like, and annular chromosomes are frequently found. The constancy of form and number indicates that the individuality of the chromosome is never lost, even in the



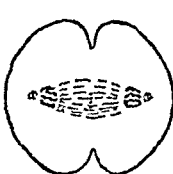
spirene



metaphase



anophase

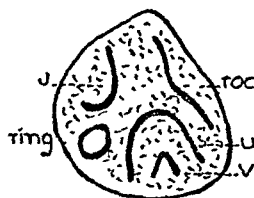


telo-phase

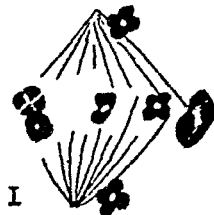
Cell Division Left to right, top

- 1 Spirene formation
- 2 Metaphase formation
- 3 Anaphase formation
- 4 Telophase formation

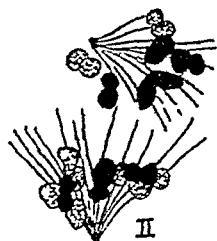
from pole to pole, and consisting of extremely fine separated threads. All these changes in the nucleus constitute the first or prophase of the division. This is followed by the metaphase, in which the split chromosomes attach themselves to separate fibres in the widest part of the spindle. Then follows the anaphase, in which the half chromosomes move along the spindle towards opposite poles. At each pole the half chromosomes, or daughter chromosomes as they are called, aggregate in the final or telophase, and thus two exactly similar new nuclei



Typical shapes of Chromosomes



I



II

I Arrangement of chromosomes on equatorial plate, showing metaphase of a reducing division

II Early anaphase of a reducing division

telophase and the reticulum and accounts for the importance attached to the chromosome in theories of heredity (*q v*)

When fertilisation occurs it appears as if the chromosome number must be doubled. Actually however in the gametes of most animals the number of chromosomes is half the number of a somatic or body cell and this is restored by fertilisation. It is evident that in such cases a reducing division must precede the formation of gametes.

In some plants the reducing division takes place after fertilisation and so for a time one or more cells exist with nuclei having twice the original number of chromosomes. These cells are diploid. Ferns, mosses and liverworts (*q v*) have a diploid spore

into gametophytes (*q v*) having the single or haploid number of chromosomes.

### Differentiation of Cells

The first cells formed by the division of fertilised ova of most plants and animals are very similar but sooner or later changes take place and cells are differentiated into tissues and organs. In animals nerve, muscle, bone and epithelial cells are merely a few of those formed by

changes in the primary undifferentiated cells. A nerve cell once formed is believed to be incapable of de-differentiation; a process other somatic cells may undergo provided that differentiation be not too firmly established. In the change of a tadpole into an adult amphibian or of a caterpillar into a butterfly or moth various cells are de-differentiated and reorganised into different tissues. Lizards, newts, many insects and crustaceans may regenerate lost tails and limbs by the de-differentiation and subsequent growth of cells at or near the wounded surface as growth proceeds. The characteristics of the various types of cells will be found described under the headings of the tissues they form. In the higher plants (*see PLANT CELLS*) the cells form the main tissues: epidermis, cortex, xylem, phloem and medulla. The higher the organism the more highly differentiated are its cells, each type becoming a specialist able to perform only its own particular function. In the lower organisms the differentiation is less complete and

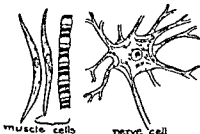


palisade chloroplast



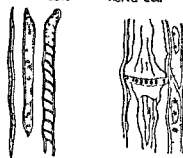
xylem

Cell has different form of chloroplasts



muscle cells

nerve cell



xylem fibres

phloem fibres

Differentiated Cells

phyte (*q v*) and reduction of the chromosome number is achieved during spore formation. The spores develop

cells may even change their function should need arise. Some of them have multiple functions. In the ultimate case of the unicellular organism, the single cell must perform every function.

CONSULT Wilson, E. B., *The Cell in Development and Inheritance*, Sharp, Lester W., *An Introduction to Cytology*.

**Cellini** [*pron* CHELLE'-NE], Benvenuto (1500-1571), Florentine sculptor and goldsmith, was the son of a musician, and was himself trained for the same profession, but on his own insistence he was apprenticed to the goldsmith,



Benvenuto Cellini

Marcone, at the age of 15. He is one of the most interesting figures of the Italian Renaissance, a man of extraordinary vitality and energy, and of exceptional talent, a craftsman of great skill, with no little inventive genius.

Music, sculp-

ture, warfare, literature, love, murder—he has left in his autobiography a vivid account of his exploits in all these fields. Before he was 20, Cellini had been sentenced to 6 months' banishment from Florence for street fighting, and had lived in Siena, Bologna, and Pisa, finally settling in Rome. Here he lived for some years, in and out of favour with the Pope and the authorities, winning great fame for his part in the repulse of the attack on the city in 1527. After returning to Florence for a time, a murder and an attempt at murder forced him to leave once more, he was imprisoned for theft in 1538, and in 1540 took service under Francis I

of France, living mainly in Paris till 1545. His life makes a most romantic adventure story, full of fighting, imprisonments, escapes from gaol and from attempts to poison him, which often interrupted his arduous pursuit of his art.

Cellini's bronze statue of *Perseus holding the Head of Medusa* in Florence is one of the best-known and most widely admired pieces of renaissance sculpture. The gold salt-cellar he made for Francis I is a wonderful example of the goldsmith's art, and a number of coins bear witness to his skill as a medallist. His autobiography (translated into English by J. A. Symonds and others) is one of the literary masterpieces of the world, revealing with a candour that is almost innocence his violence of character and audacity, his immorality and piety and superstition, his devotion to his work, his conviction of the malevolence and wickedness of all his enemies, and of the supreme merits of Benvenuto Cellini.

**Cellophane**, a thin transparent material made from cellulose by a proprietary chemical process resembling that used for the manufacture of artificial silk. It is widely used as a wrapping material, being proof against air, oil, and moisture. It is also employed in lining the gas-cells of airships.

**Cellosolve**, the commercial name for *ethylene glycol mono-ethyl ether*, an organic solvent having a boiling-point of 135° C. which is manufactured by a series of reactions from ethylene gas. It is an excellent solvent for nitrocellulose, and is employed to a considerable extent in the manufacture of cellulose lacquers and lacquer thinners.

**Celluloid** (*Xylonite*), a plastic material consisting of a solid solution of nitrocellulose (*qv*) in camphor. It is manufactured by taking the lower nitrates of cellulose (containing about 10 per cent of nitrogen), and, after bleaching, mixing them with a suitable solvent such as alcohol or, more rarely, acetone. About 20 per cent of camphor

is then added (together with a pigment should it be desired to produce a coloured cellulose) the mixture is then passed between rollers to ensure even distribution of the ingredients and then pressed into shape whilst hot. On the evaporation of the solvent celluloid is obtained.

Celluloid is extremely inflammable and in order to decrease this undesirable property cellulose acetate is sometimes used instead of the nitrate. Substitutes for camphor are also employed in order to reduce both the inflammability and the cost. These are not wholly satisfactory. The more commonly employed substances are plasticisers of high molecular weight such as *tricresyl phosphate*.

If celluloid is heated to about 75°C. it becomes plastic and can then be moulded into any desired shape on a hydraulic press. Celluloid is used in enormous quantities for the manufacture of a large number of articles such as photographic film, toys, combs and in producing imitation bone, ebonite, amber and tortoiseshell. See also CELLULOSE.

Cellulose chemically a carbohydrate or compound of carbon, hydrogen and oxygen, the latter two in the proportion in which they form water. Its formula is some multiple of  $C_6H_{10}O_5$ . The exact chemical constitution is not known but in its naturally occurring form of plant fibre of which it forms the main constituent it has a regular structure as shown by X-ray analysis (see CRYSTALS). It does not dissolve completely in any solvent but its molecular weight has been estimated at about 40,000. It contains 3 OH groups to every 6 carbon atoms and is thus able to form compounds with acids (esters) in which it acts like a base. The nitrate, acetate and xanthogenate are of great importance in technology. It also acts like an alcohol reacting with caustic soda to form unstable compounds. These are decomposed by water, the cellulose remaining being of the same chemical composition but more reactive towards

water and dyes. Hydrogen ions hydrolyse cellulose first producing hydrocellulose and finally dextrose, a sugar of the formula  $C_6H_{12}O_6$ .

The main sources of cellulose for technical purposes are cotton, flax and wood, the latter including a large number of woody fibres forming the stems of plants such as straw, many grasses and the husks of certain seeds.

*Cotton* is a seed hair and in its natural state contains from 85 to 90 per cent of pure cellulose. It is largely used as a textile fibre (*qv*) but also especially as waste from textile processes as a raw material in the manufacture of cellulose products. *Linen* fibre or flax is used only as a textile, the best qualities of paper being made from linen rags. The chief source of cellulose is *wood pulp*. Wood contains less cellulose than cotton, its content varies greatly but is roughly 50 per cent. The chief other constituent is *lignin*, the constitution of which is not known, further oils, fats, waxes, tannins and resins are present.

One of the greatest industrial developments has taken place in the use of what are called *cellulose esters*, that is to say the compound of cellulose with various acids.

*Cellulose nitrate* is formed by the action of nitric acid upon pure cellulose, for this reason it is often incorrectly called nitrocellulose. Nitration is effected by acting on the cellulose (nearly always in the form of cotton previously purified by treatment with caustic soda) with a mixture of nitric and sulphuric acid. Highly nitrated cellulose is known as *gun cotton* and contains over 13 per cent of nitrogen (see EXPLOSIVES).

Less nitrated cellulose does not explode but burns very readily; it is used for cinematograph films of the common inflammable variety.

*Cellulose acetate* is formed by the action of a mixture of acetic anhydride  $(CH_3CO)_2O$ , acetic acid  $CH_3COOH$  and sulphuric acid upon cotton. *Cellulose xanthogenate* is formed by the



action of carbon bisulphide,  $\text{CS}_2$ , upon cellulose, which has been treated with caustic soda and then pressed. It dissolves in dilute solutions of caustic soda.

Cellulose also dissolves as such in various solvents, among them *cuprammonium hydroxide* (a solution of copper oxide in ammonia), concentrated zinc chloride, and sulphuric acid, though the latter decomposes the cellulose slightly.

There are four chief industrial uses for cellulose products, apart from explosives. They are used as *plastics*, that is to say, substances which can be moulded in steel moulds, under great pressure. The best and longest known of these is *celluloid*, which is made by mixing cellulose nitrate with camphor and other substances, which render it plastic. It readily takes a great variety of beautiful colours, and opaque filling materials and excellent imitations of materials such as ivory, tortoiseshell, amber, and rare woods, can be made from it. It has the great drawback of being dangerously inflammable, though not explosive. It is, therefore, being displaced to some extent by *cellulose acetate*, which is a waste product of artificial silk manufacture. (*But see PLASTICS*)

Photographic film is made both from cellulose nitrate and cellulose acetate, the former being what is known as inflammable film, allowed only in cinemas specially built to avoid the risk of fire, and the latter being used for safety films, or "non-flam," on which educational films, and those intended for home use, are printed. Even this material is, however, fairly inflammable. The only really safe material for films is viscose (*see below*).

The cellulose esters are all soluble in certain solvents, acetone ( $\text{CH}_3\text{CO}$ ), being the most active, though exceedingly volatile, and amyl acetate,  $\text{CH}_3\text{COOC}_5\text{H}_{11}$  (well known by its smell like that of peardrops), which is less volatile. These solutions form the basis of cellulose lacquers and paints. *See also ARTIFICIAL SILK, PAPER-MAKING, PAINTS AND VARNISHES*

**Celmonite**, *see* EXPLOSIVES.

**Celsus, Anders** (1701-1744), Swedish astronomer, is remembered for his methods of determining the distance of the sun from the earth, the size of the earth, his observations on the *aurora borealis*, and his invention of the centigrade thermometer (1742).

**Celtic Languages**, one of the main branches of the Indo-European group of languages (*see* Table, INDO-EUROPEAN LANGUAGES), standing in closer relationship to the Italic group than to the other branches. They are classified as (1) Gaulish, (2) Goidelic, and (3) Brythonic. The first of these is extinct, and survives only in place-names over an area extending from Westphalia to the Dniester. It was the speech of ancient Gaul. Goidelic includes Manx, Gaelic, and Irish, and Brythonic comprises Cornish, Breton, and Welsh.

**Celtium** (chem.) The alternative name for the element HAFNIUM (*q.v.*).

**Celts**, an ancient European race. The name has been misapplied to the dark-haired inhabitants of France, Britain, and Ireland, but in its original form (*Keltai*), as used by the Greeks, it was applied to all fair-haired, blue-eyed, and tall peoples living N of the Alps. These races are divided by modern writers into two physical groups: the long-headed Teutonic (Scandinavian or Nordic) and the round-headed Alpine, and much confusion has arisen from the fact that the Teutons were called Celts by the ancients, while the Alpine races are called Celts by the moderns.

The most famous of the Celtic tribes were the Umbrians (Alpine) and the Cimbri (Gallic), each of these invaded E and S Europe, the former reaching as far as Sinope and the latter Pontus in Asia Minor. The Celts invaded W. Europe also, and many settled in England, Ireland, and Scotland about the 6th cent B.C. Later invaders (*see* ENGLISH HISTORY) drove them W. and N. into the more remote or mountainous districts, where their descendants and relics of their lan-

guages and literatures have lived on (*see also* CELTIC LANGUAGES and WELSH SCOTTISH IRISH AND BRETON LITERATURE)

The religion of the Gallic and British Celts before Romanisation was Druidism (*qv*). Celtic art during the Bronze and Iron Ages attained a high degree of excellence and in later pre-Christian times the ornamentation of shields, harness and bracelets by means of repoussé design and coloured enamels is of a high standard. After the introduction of Christianity the most important development in Celtic art was the illumination of MSS. of which the beautiful work the Lindisfarne Gospels in the British Museum is an excellent example.

**Cementite** *see* CARBIDES IRON AND STEEL

**Cements and Mortars** These are all mixtures of powdered substances which when wetted with water set with greater or lesser rapidity to a more or less hard and mechanically resistant mass. This setting is a rather complicated matter. The simplest instance is that of plaster of Paris which consists of gypsum (calcium sulphate  $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ ) which has been heated to a temperature of 120–130° at which three-quarters of the water is evolved forming the substance  $2\text{CaSO}_4 \cdot \text{H}_2\text{O}$ . This is much more soluble in water than gypsum and hence immediately dissolves to saturation point in the water added to the plaster. The resulting solution is greatly supersaturated with respect to gypsum which then separates out in fine crystals leaving the water free to dissolve more plaster the process continuing if sufficient water is present until the whole mass is re-converted into gypsum and consists of a closely interlocked mass of fine crystals. This interlocking of fine crystals is characteristic as the source of strength in many cements.

Keene's cement is made by burning very pure gypsum at a red heat soaking it in an alum solution drying and again burning at a high temperature.

Mortar as used for building purposes consists of a mixture of about 1 part of lime to 3 or 4 parts of sharp sand. The ingredients must be mixed very thoroughly and the lime must be of good quality. The mass sets hard enough for ordinary structural work in a few days this being due chiefly to simple drying out of the water. This allows the carbon dioxide of the air to combine with the lime to form calcium carbonate which is a crystalline substance and forms a bond between the grains of sand. In the course of centuries there takes place to a small extent the further process of a slow combination with the silica to form calcium silicate.

What are called hydraulic cements are of continually growing importance on account of the number of uses to which they can be applied. The name is derived from their property of hardening under water which is not possessed either by plaster of Paris or mortar since both these are soluble in water at first. These materials are classified into hydraulic limes, Romaneement, Portland cement and slag or Puzzolan cement.

Portland cement is an artificial hydraulic mortar and gradual improvements in its composition and method of manufacture together with the cheapening of its cost are rapidly leading to its supremacy as a constructional material for which purpose it is used as a binder mixed with sand, gravel, pebbles etc. forming concrete. It is made by combining a material containing a high percentage of calcium such as limestone or marl with a substance consisting of silica, iron oxide and alumina such as shale or clay. The two materials are ground together very finely either wet or dry according to the process and then heated to a very high temperature 1400–1600° which causes the mixture to sinter that is to say to aggregate into clinker by the partial fusion of the ingredients. These lumps of clinker are then once again ground to

extreme fineness, a small percentage of gypsum being as a rule added.

So important is the composition of cement that it is now usual, in spite of the vast scale of manufacture, to collect the finely ground mixture before burning into storage, while it is being analysed and having its composition corrected by the addition of one or other of the ingredients. The addition of plaster of Paris or gypsum retards the setting of the cement, which would otherwise be too rapid for ordinary use in building.

**Cenci** [CHEN'-CHE], Beatrice (1577-1599), ill-fated daughter of Francesco Cenci, born in Rome, and imprisoned with her stepmother Lucrezia in a castle, where she is said to have been raped by her father, and to have plotted his murder, was refused a pardon for the crime, and was beheaded with her mother. Two sons, also implicated, were convicted. Cenci's life has been dramatised by Shelley and other poets.

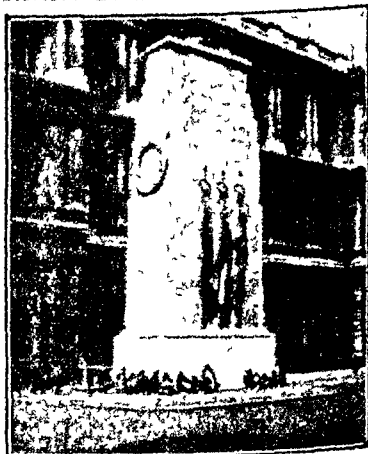
**Cenis, Mont**, Alpine pass in Savoy (France), 6,800 ft. A road constructed by Napoleon crosses it, and there is a railway tunnel of the same name a few miles W, more than 7 m long.

**Cenobite**, early Christian term for a monk, living in a religious community, as opposed to a hermit or anchorite.

**Cenomani**, an ancient people living in Gaul, inhabiting what later became the province of Maine, who invaded Italy in the 4th cent B.C., some of them settling in N Italy. They were allies of the Romans, but joined in the revolt of the Gauls, 200 B.C.

**Cenotaph** (Gr *kenos*, empty, and *taphos*, a tomb), a memorial raised in honour of one whose body is either irrecoverable or buried elsewhere. A famous cenotaph, designed by Sir Edward Lutyens, was erected at a cost of £10,000 in Whitehall, London, in 1920, in memory of those who died in the World War, and is the scene of a commemorative service on the anniversary of the signing of the Armistice (Nov 11th, 1918). In 1919, a tem-

porary wooden cenotaph was erected to be replaced by the present simple stone structure a year later. The inscription reads simply *To Our Glorious Dead*.



The Cenotaph, Whitehall

**Censor**, ancient title of Roman officials whose duties included the control of all matters relating to the census and registration of citizens, taxation, and the exclusion of any individual from public office on moral grounds. It is specifically associated with the name of the elder Cato (*q.v.*). In its modern meaning the term is applied to certain supervisors of the morals of non-collegiate students at the Universities of Oxford and Cambridge, and to the Lord Chamberlain by virtue of his office as licenser of stage plays. *See also* CENSORSHIP.

**Censorship**, in its general meaning, is applied to any restrictive or prohibitive action taken by an authoritative body in respect of the publication or propagation of untrue, misleading, harmful, or inconvenient statements or opinions. It has been variously exercised in different countries at various times. Printed publications are, in some European countries, notably Italy, Russia, and Germany, subject to strict Governmental censorship, but in Eng-

land the Press has since 1695 enjoyed almost complete liberty subject to the laws concerning blasphemy obscenity and sedition and except in times of war. In Roman Catholic communities moreover all printed books are subject to a religious censorship the material result of which is the *Index Librorum Prohibitorum* (q.v.).

It is to stage plays that the activities of the censor in England are mainly devoted for no play may be publicly performed until it has been sanctioned by letters patent from the Crown or licensed by the Lord Chamberlain. Several efforts have recently been made to abolish these restrictions. Cinematographic pictures are in some countries as in the Irish Free State and the U.S.A. subject to some degree of Governmental censorship but in England the film industry is free from Government interference and has voluntarily submitted itself to the censorship of a British Board of Film Censors under the supervision of a president. The Postmaster General may even in peace time be empowered to open and suppress postal communications of a specified character.

In war time all existing forms of censorship are tightened up and additional forms are introduced as a measure of national expediency.

**Census**, an official numbering and survey of the inhabitants of a State. Detailed censuses of population agriculture and produce were taken in Babylon before 600 B.C. and also in Persia, China, and Egypt while the Old Testament records the numbering of the tribes at the Exodus and again under David. The Roman quinquennial census was extended from Italy to the whole empire by Augustus in 5 B.C. Throughout the Middle Ages the Biblical disapproval of enumeration was feared and it was not until the 18th cent. that sporadic experiments were made in Germany (14), Sweden (1748), Denmark (169), Spain (187) etc. In Great Britain a regular decennial census was initiated in 1801 when numbers of persons houses and

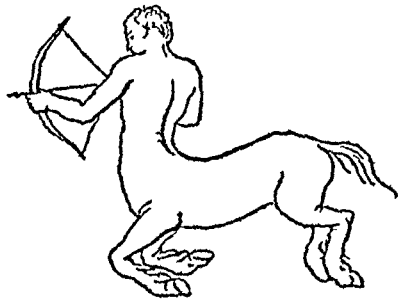
families in the parish were noted. A clause covering the broad occupational division resulted in a certain amount of confusion but more accurate results have been obtained since 1911. In 1841 the return demanded considerably greater detail especially concerning individuals instead of families. In 1871 the census was extended over the whole Empire. The amount of information required and gained has steadily increased with each census and now includes particulars of the duration of marriages the number of children per marriage the number of rooms per house the occupations and industries of those recorded etc. A decennial census was first undertaken in the U.S.A. in 1790 and since 1903 has been undertaken by the Department of Commerce and Labour. It now covers besides population statistics concerning the blind deaf dumb and insane birth and deaths crime and pauperism religious bodies agriculture electric lighting and telephones. Each census costs over £1,000,000. In most countries the census is decennial but in France and Germany quinquennial. Census returns provide reliable data for the calculation of budgetary provisions social insurance risks military manpower electrical distribution etc.

**Census of Production** an official survey of agricultural industrial and mining activity in the State. The first such census was taken in Great Britain in 190. It was decided to repeat the survey every five years but the World War interrupted until 1914. A census was taken in 1930. The 1907 survey covered the United Kingdom and examined the output of the cost of materials used in and the mechanical power employed at every individual establishment. To preserve business secrets however many sections of the return were not compulsory. Comparison of census figures shows changes in the relative importance of different industries movements in labour increase of mechanical power increase in output per head etc. In the

U S A , from 1810, the kinds, quantities and values of manufactured goods, and the number of establishments and machines, were included in the ordinary census (*qv*) In 1900 a quinquennial production census was introduced, and in 1920 it was made biennial, while the minimum annual output necessary to record was raised from \$500 to \$5000 In most other countries surveys are limited to products or to a few selected industries

**Cent and Centime** (*Lat centum*, a hundred), small coins one-hundredth part the value of the standard unit in the country concerned The *cent* is current in the USA and Canada, where it is of bronze and one-hundredth of a dollar, and in Holland, where it is of copper, and one-hundredth part of a guilder, the former being worth  $\frac{1}{100}$  d, and the latter  $\frac{1}{100}$  d at par The *centime* originated in France as one-hundredth part of a franc ( $\frac{1}{100}$  d pre-War) Its equivalent was adopted in Belgium, Switzerland, Italy, Spain, and Greece, though subsequent fluctuations have made the value of each distinct

**Centaura** [*pron SENTŌ'RIA*], a genus of plants belonging to the *Compositæ* family The name comes from the Centaur Chiron, who is said to have cured a wound in his foot with the plant The wild species, greater and lesser knapweed, are bushy plants with coarse leaves and purple flowers The cornflower is a popular garden plant of the genus

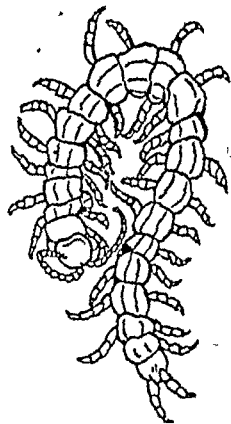


Centaur

**Centaura** [*SEN'TAWZ*], a legendary Thessalian race of monsters, half man and half horse, the offspring of Centaurus, son of Apollo. Their conduct at a marriage feast led to a battle with the Lapithæ, in which, as in a later battle, they were defeated by Hercules Chiron, Hercules's foster-father, Lyceus, and Pholus were best-known of the tribe

**Centaurus** (*astron*), see CONSTELLATIONS.

**Centaury**, a pretty herbaceous wild plant belonging to the Gentian family, 2-18 in high, with square erect stems and many upper branches, terminating in flat tufts of small rose-coloured flowers, the leaves are oblong, with strong parallel veins The flowers expand only in fine weather, and are found in dry fields and on chalk downs



Centipede

**Centipedes**, form a class of the *Arthropoda* (*qv*), known as *Chilopoda* They resemble insects in having a single pair of antennæ and in the generative organs opening at the hinder end of the body, but differ in that the body consists of a series of similar segments, each of which is provided with a pair of legs, and in possessing four pairs of jaws, the outer pair forming powerful poison fangs

There are many different species of centipede, belonging to several families, differing in the number of legs present and other features. The legs vary in number from 15 to over 50 pairs, but the number is always odd. The

species with numerous legs are blind and mostly subterranean feeding on earthworms. The others generally have eyes and are more active and more varied in diet eating insects grubs and other small animals and living under stones and fallen logs.

Centipedes are found in all temperate and tropical countries. Some tropical species are of large size the giant centipede of S America being nearly a foot long. But their venomous bite although very painful is seldom dangerous to human life.

**Central America**, section of America lying between the isthmuses of Tehuantepec (Mexico) and Panama. It comprises British Honduras, Guatemala, Honduras, Salvador, Nicaragua, Costa Rica and Panama (qqv).

**Central Banks.** An exact definition of a central bank is rendered difficult because central banking systems have evolved differently in different countries. The system in England as it exists to-day with only slight changes was established by the Bank Charter Act of 1844. This Act gave the Bank of England the principal functions and characteristics which are to be found in central banks to-day though all the functions and all the characteristics do not apply to all existing central banks. By examination of these functions and characteristics a general idea of the central bank may be obtained.

**Note Issue.** (1) Legislation in England gave to the Bank of England the sole right in England and Wales of issuing bank notes and strictly regulated the conditions of the issue (see BANK OF ENGLAND, BANKING AND CREDIT). Thus the responsibility for a sound and adequate currency was vested in the Bank of England. The same applies to all the world's credit banks though in a few countries credit banks do not hold a monopoly of note issue but share it with private banks—e.g. the National Banks in the U.S.A. Scottish banks and certain banks in Germany have certain note issue rights, regulated by statute—but

in these countries the credit bank also has a note issue.

(2) Having charge of the note issue the Bank of England holds gold reserves against it and normally pays gold on demand. Thus a joint stock bank with a deposit account at the Bank of England can regard this account as cash. This fact centralises the general banking and currency reserves of the country lending great stability to the whole banking system. The centralisation of banking reserves is probably the most important function of a credit bank. It was the chief object in the establishment of the *Federal Reserve System* (qr) in the United States. A prominent authority on central banking (Sir Ernest Harvey, K.B.E. Comptroller of the Bank of England) has said that whilst the issuing of bank notes is an important function of a credit bank it is only so by reason of the power which the exclusive right of note issue confers upon the bank to discharge efficiently what I should prefer to describe as its primary function namely the custody regulation and protection of the central banking and currency reserves of the country. This seems all the more evident when it is remembered that in more than one important country the credit bank does not have exclusive right of note issue but in all cases has the custody and regulation of the central reserves.

(3) The Bank of England from its foundation in 1694 has been entrusted with the entire banking business of the Government. This is a feature of practically all existing central banks to-day.

(4) The Bank of England is the banker of the joint stock banks and the settling agent for clearing differences between them. The same or a similar relation exists between most central banks and the trading banks in the countries concerned.

(5) The Bank of England stands always ready to re-discount approved bills of exchange at a minimum pub-

lished rate of interest, thus assuring a source of credit to ease the money market when its ordinary funds are temporarily inadequate to finance the commercial business of the country. Though the working of the money markets in various centres differs, this general principle of central banking business will be found in them all, *e.g.* the Federal Reserve Banks in the United States re-discount commercial paper of certain specified types offered to them by banks and other houses, continuously—and not merely when other sources of credit are temporarily inadequate—but the total amounts re-discounted expand and contract according to the needs of the market as gauged by the Federal Reserve authorities.

Other important functions of central banks are the regular (usually weekly) statements of their position. There is also the necessity of keeping their assets very liquid, and, especially according to British tradition and belief, the desirability of their being non-political in character. The last-named feature is by no means universal, nor is it probably absolutely complete in any country. Moreover, a central bank, though it may be a private concern, must put the interests of the country before its profit-earning function. For this reason it is usually considered desirable that a central bank should not take moneys deposited with it at interest, since the obligations to pay interest might restrict its freedom of action. It also follows that a central bank should not ordinarily compete with trading banks—though to a small degree the Bank of England does so compete in some lines, having a limited number of ordinary depositors to whom it makes advances, as do other banks.

The following are some of the more important existing central banks:

Bank of England—founded 1694

Bank of France

Reichsbank (Germany)

Banque Nationale de Belgique

Banca d'Italia

Swiss National Bank

Norges Bank (Norway)

Bank of Sweden

Federal Reserve System (U.S.A.), 12 regional banks

Reserve Bank of South Africa

A number of central banks were established in S. America under the advice of Prof. Kemmerer, an expert on central bank currency problems. One of the countries without a central bank is Canada, where a commission has recently been appointed to study, among other things, the desirability of establishing one.

**Central Criminal Court**, commonly called the Old Bailey, was created in 1834 for the trial of all offences committed in London, Middlesex, and certain parts of Essex, Kent, and Surrey. It also has jurisdiction in regard to several offences committed outside its ordinary limits, *e.g.* on the high seas, and indictments for offences outside its jurisdiction, upon removal by *certiorari* (*q.v.*) into the King's Bench Division, may be ordered to be tried there if it is expedient, *e.g.* on account of local prejudice against the person charged. The Court is, in general, constituted of one or more Judges of the King's Bench, the Recorder of London, the Common Serjeant and the Judge of the City of London Court, each of whom sits separately with a jury. Its present building occupies the site of Newgate Prison (*q.v.*).

**Central Heating**, the warming of a whole house from one fire, the heat being conveyed to every room by hot air, water, or steam. The Romans had a system of heating by *hot air*, distributing this in a hollow space under the floor. Hot-air systems as used in modern times consist in supplying a current of air heated by a central flow directly to the room. This is not satisfactory for small houses and buildings without fans. In the modern "plenum" system, however, air is sucked in from outside, filtered, given the right degree of moisture, warmed, and forced into the building, the foul



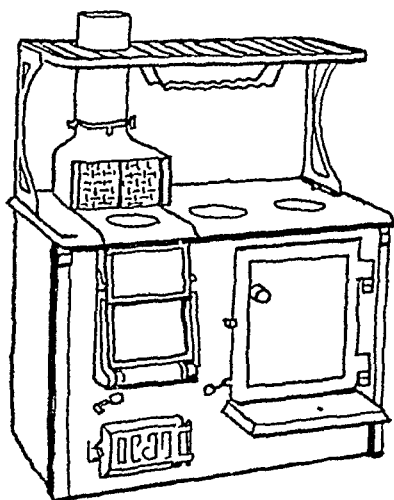


hot air in the correct proportions needed for health

For the actual furnace under any system, coke, anthracite, or oil may be used (*see FUELS, SOLID*), coke requiring more stoking than anthracite, while the oil supply needs no attention and is more reliable, giving an easily controlled heat which may also automatically be kept even

On the other hand, an oil burner is more noisy and more expensive to install

The black-leaded finish of early



Combined cooker and water heater

boilers, which required extensive cleaning, has been replaced by vitreous enamel in grey mottic, plain green, or dark brown, requiring only a quick rub with a moist rag

Tedious lighting of coal fires, too, is eliminated, by use of a gas poker, lighted with a single match and in turn igniting the fuel

Where a coal range is burned all day, a combined cooker and central heater is successful. Even a small model will heat two radiators. Alternatively, an independent boiler might have a small oven above, excellent for heating

casseroles, or milk puddings and other dishes, which require only a moderate oven. Again, sufficient heat is wasted at the back of a sitting-room fire to heat a boiler connected to two radiators close at hand. Two large stoves would heat a two-storied house, one in the hall could run radiators in 2 sitting-rooms and 2 or 3 in bedrooms above, and another stove in the kitchen could supply 2 more bedrooms and domestic hot water

The pipes conveying hot water may themselves act as simple radiators, running along a wall in a bathroom, through a linen cupboard, acting as a hot towel-drying rail. Where they are intended merely as a connection link, insulation with a heat-resisting packing will increase the efficiency of actual radiators. The boiler is also sometimes packed for the same purpose with silicate cotton or an asbestos composition. This packing also diminishes the risk of burst pipes through freezing. It is advisable to keep domestic hot-water and radiator systems separate, as differences in construction are appreciable, but they can be used off the same heating unit, though without full efficiency.

Columnar radiators have become more compact, saving floor space, yet with a greater effective radiating surface. They can be painted to harmonise with colour schemes, remembering that a dull dark surface gives more heat than a bright, light one. Wall radiators are decorative, efficient, and save much space. Radiators may be built into the walls and resemble panels, being almost invisible yet losing little efficiency. *See also HOT-WATER SUPPLY, HEATING ROOM*

*CONSULT. Heating, Ventilating and Air Conditioning*, by L. A. Harding and A. C. Willard (New York, 1932). *Heating Systems*, by F. W. Raynes (London, 1921). *Good Housekeeping with Modern Methods*, "Good Housekeeping" (London, 1933)

Central India, a group of Indian States forming a political division, and administered by the Central

**India Agency** They are bounded on the N by the United Provinces and Rajputana S by the Central Provinces and E and W by Chota Nagpur and Bombay respectively They are divided N-S by a narrow extension of the United Provinces The Agency comprises upwards of 85 States varying considerably in area and in their method of allegiance to the British Crown for many years Gwalior was a constituent State but it is now directly under the Viceroy The surface is mainly hilly and much of the soil is extremely fertile cotton and grain are largely grown and there is a considerable manufacture of silk cotton and opium The chief towns include Indore Bhopal and Rewa Area 51 600 sq m pop 6 6 x 1000

**Centralisation**, the concentration of power and administration in a central State organisation as opposed to decentralisation or the delegation of administrative powers to local or provincial bodies Centralisation which entails a considerable increase in the functions of the State is a common tendency in civilised countries and is coincident with the unifying effect of national and international economic organisation

**Central Provinces and Berar** Indian district mostly British the remainder being under British influence bounded N by the Central India Agency S by Hyderabad E by Orissa Bihar and Madras and W by Bombay There are 4 main divisions Jubbulpore Nerbudda Nagpur Chhattisgarh and Berar The surface consists of hills and plateaux with great plains between the principal elevations are the Maikal Range to the E and the Satpura Range in the S and the district is watered by the Nerbudda and Tapi Rs flowing W to E the Wainganga in the S and the San and various tributaries of the Jumna in the N The climate is temperate on the whole with a fair rainfall though it tends to a dry summer heat in the S there is good irrigation and agriculture is

flourishing The principal crops are cotton wheat rice oil seeds and timber much is done in the way of security of tenure agricultural banks and societies to encourage agrarian interests The minerals which are of increasing importance are coal though of a poor quality and manganese Communications are good large sums having been spent on the railways The chief towns are Nagpur the capital Jubbulpore Raipur and Akola The majority of the natives are Hindus Gond or Mohammedans Area 131 000 sq m pop 15 000 000

**Central School** a school designed for selected pupils from elementary schools who not being judged likely to profit by a secondary education or showing more practical than theoretical ability are transferred from elementary schools when between 11 and 12 The age limit is 16 instead of 18 as at most secondary schools and the subjects taught are either commercial or technical as opposed to the preparation for university education which is general in secondary schools Central schools were first established in London in 1911

**Centrifugal Force** *see* DYNAMICS  
**Centrifugal Mills**, *see* CRUSHING AND GRINDING

**Centrifuge** (or *centrifugal*) a valuable apparatus for speedily separating mixtures of liquids with liquids or with solids where the gravity would effect a slow separation The simplest type of centrifuge consists of an open cylindrical vessel into which fits a second perforated vessel or *basket* which can be rotated very rapidly about a vertical axis Into this any type of solid wet with a liquid is put When the basket is rotated the liquid drains from the solid under the action of centrifugal force (*see* DYNAMICS) which if the speed of rotation be sufficient may greatly exceed the force of gravity The liquid is caught by the outer fixed vessel When the solid is very fine or when it is necessary to separate two liquids the per

forated basket cannot be used, and is replaced by one with impervious walls. The solid, or heavier liquid, then collects against the sides, and needs to be removed from time to time.

**Centripetal Force**, see DYNAMICS.

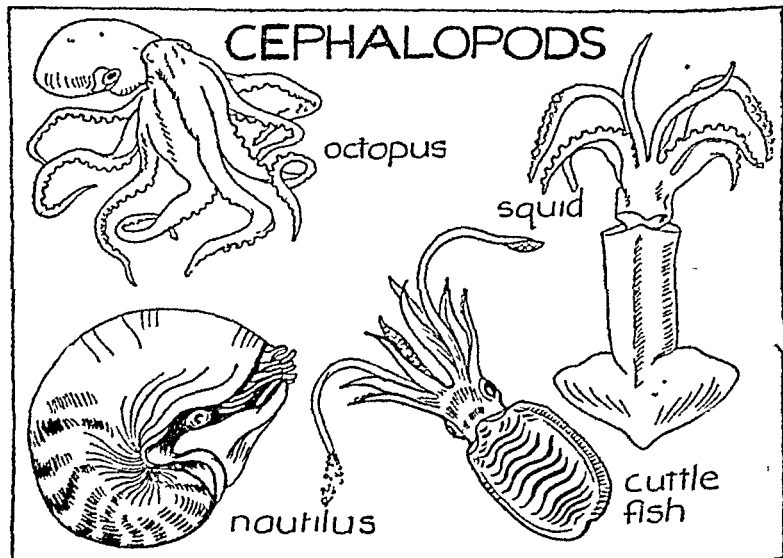
**Centrosome**, see CELL.

**Ceos**, Greek island in the Cyclades ( $13 \times 8$  m), Ægean Sea, noted for its fertility and agreeable climate. Local products include lemons, olives, wine, citrons, etc. Mount St Elias (1860 ft) is the highest point. Ceos was the

by Venetians, Turks, French, and British, and is now Greek. Area, 256 sq m., pop 66,000.

**Cephalopoda** [*from* *KEPHALO*'*PODA*], a class of Mollusca (*q.v.*), including the cuttle-fish and nautilus, divided into two orders, the Dibranchiata and the Tetrabranchiata.

The Dibranchiata have 2 gills, 2 kidneys, and 8 or 10 tentacles, which are provided with suckers. The shell is internal or absent, the funnel is a complete tube, and an ink-sac is present.



birthplace of Simonides, the Greek poet. Pop 4500.

**Cephalic Index**, see ANTHROPOLOGY (PHYSICAL).

**Cephalonia** (*Kephallenia*), island off the W coast of Greece, the largest of the Ionian group, mainly mountainous, culminating in Monte Negro (5200 ft). Currants, olives, and grapes are grown, and the minor industries include boat-building, lace, and carpets. Cephalonia has many important ruins of Greek and Roman civilisation; has been held successively

These cuttle-fishes are subdivided into the Decapoda, which have 10 tentacles and an internal shell, and include the existing cuttle-fish (*q.v.*), squids (*q.v.*), and the extinct belemnites (*q.v.*), and the Octopoda, which have 8 tentacles and no internal shell, and include the octopus (*q.v.*) and argonaut (*q.v.*).

In the Tetrabranchiata there are 4 gills and 4 kidneys, numerous tentacles without suckers, no ink-sac, and a funnel composed of 2 flaps. The animal lives in the outer chamber of a many-chambered shell, to which it is

attached by a tube running through the shell partitions To this order belong the existing nautilus and the extinct ammonites (q q v)

Cepheus see CONSTELLATIONS

Ceram, island in the Moluccas Dutch E Indies The surface is mountainous culminating in Mount Nusa Keli (c 10 000 ft) There are numerous small rivers The interior is largely unexplored and covered with luxuriant forests In the valleys and on the coast sago is produced th



Vic and More  
Staffordshire pottery group by Ralph Wood.

other staple product is copra The natives are tractable but backward

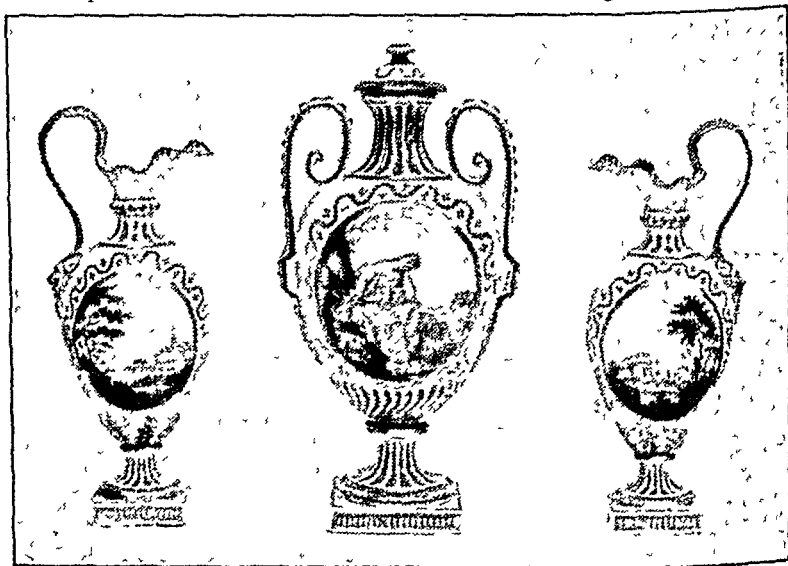


T b J g Staffordshire pottery by Ralph Wood  
there are few white settlers Area  
6500 sq m pop 90 000

Ceramics the general name given to the art of producing objects from burnt clay Natural clays vary greatly in their properties for ceramic purposes only pure china clay is suitable for the manufacture of the highest class of ceramic ware porcelain (q v) but the blue or ball clays are nearly as pure and when fired are almost white though their colour as dug may be very dark owing to the presence of organic matter Fire-clay (q v) contains a large proportion of silica The plasticity of clay a property very necessary for its use in ceramics must be in some way connected with the water combined

with it, since it is destroyed when this is driven off by heat. Very plastic clays are not suitable unmixed for use in ceramic work, as they dry unevenly and tend to crack. They are, therefore, mixed with a ground non-plastic material or *grog*, which may take the form either of broken sherds or burnt clay, also known as *ballast*. The correct fineness of such grog or ballast is of importance, and is found by experiment in particular instances.

called *pugging*. If the addition of grog is necessary, it is made at this stage. Four types of operation are used in this process. *Tempering* is the name given to working the clay by spades, hands, or feet; it is employed only in very primitive conditions. The *pugmill*, consisting of a metal cylinder containing a rotating shaft armed with knives, is commonly used for soft clays. The *panmill* is very similar to an edge-runner mill (see



Set of three Derby Vases

Clay (*q v*) always requires purification before use. It may be made into a paste with water and forced through a screen, which requires the expenditure of considerable power, or alternatively the clay is thinned with water, and the liquid agitated or caused to stream at such a rate that the impurities settle while the much finer clay particles are carried on to settling pits, where they are slowly deposited.

The process of mixing the clay so as to make it uniform for working is

CHEMICAL ENGINEERING), and can operate on stiffer material than the pugmill. The *plungers* or *blunging arks* consist of a vertical cylinder with a vertical rotating shaft in the centre, armed with blades of propeller shape. These thoroughly mix softer material, but are suitable only when the consistency is that of a slip.

The composition of the different kinds of ceramic ware is determined by three main considerations: (1) the temperature required for burning, (2) mechanical strength of the materials

produced (3) its resistance to the action of heat both wet and dry. No material fulfils all three requirements ideally the most perfect from the two latter points of view. *porcelain* requiring an excessively high temperature for firing. Porcelain was invented in China and is made from pure kaolin (qv) only this word being derived from the I auling Mountains in China. Pure kaolin however gives a porous substance when heated to a very high temperature and though vessels of

ware pipes and vessels of all kinds are used wherever corrosive liquids require to be dealt with.



Cope bag. Chu p. f. Lo. re.

this material are occasionally used on account of the extremely high temperatures which they will stand they are inferior to porcelain for ordinary use. The secret of porcelain making consists in adding a small quantity of a more fusible substance called a *frit* or *flux* to the clay. This frit is usually *felspar* the double silicate of aluminium and one or both alkali metals from which clay is formed by weathering. The effect is to frit the mass together and eliminate porosity almost entirely.

Earthenware is glazed by throwing common salt into the kiln when burning is nearly complete. The alkali vapour attacks the surface of the clay and forms a fusible glass which is extraordinarily resistant to water and chemicals. Hence salt glazed earthen



Arm. 11 Jug. C. 1. f. Arm. 1. Al. 1. f. v. 1800. The use. Early 18th c.

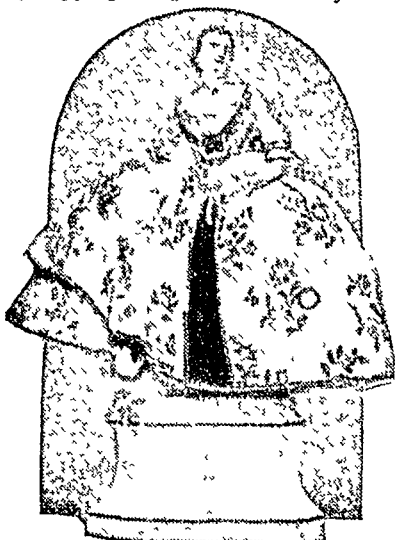
*Common pottery ware* is made from impure clays and burnt at a comparatively low temperature. It is useless for making ordinary domestic vessels.



Rhodin Dish flow red blue

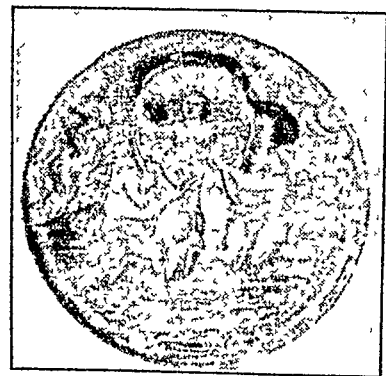
unless glazed and the problem of making glazes to suit particular types of ware is very important. Apart from

salt glazing all ceramic ware is glazed by dipping the goods, after they have



Dresden figure of Countess Koesel

been fired and cooled, in a suspension of the glazed material in water. The glaze forms a coating on the ware, and this is then again fired to melt the

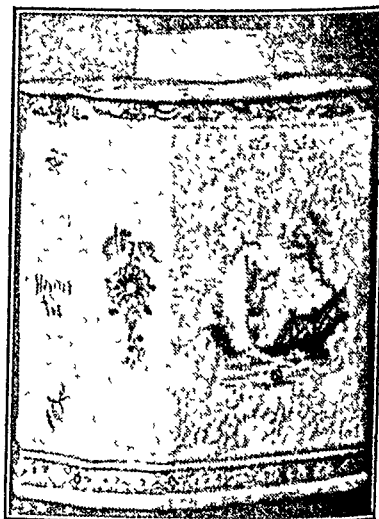


Gubbio Dish "Amora rising from the ocean," after Marcantonio Raimondi, 1538

glaze, which forms a glassy coating over the surface and removes its

porosity. Since the ware has to cool down from firing temperature after this process, and is afterwards frequently exposed to heating and cooling when in use, the glaze needs to have the same coefficient of expansion to heat as the body of the ware.

The shaping of the plastic clay is effected by a variety of processes. The oldest of these is termed *throwing*, in which use is made of the potter's wheel, a disc of wood rotating rapidly on a vertical axis. It is a high



Lowestoft China

skilled art, and is rapidly being displaced, for ordinary purposes, by moulding and other processes. Moulding is itself by no means a new invention; it depends upon the use of a highly porous mould, into which a clay slip is poured in sufficient quantity to form a coating of the desired thickness. The porous mould, which is commonly of plaster of Paris, rapidly absorbs the water and condenses the suspended clay upon its surface in a form sufficiently coherent to allow of its removal from the mould. The process of *electrosmosis* ( $qv$ ) also enables clay to

be deposited on a mould in this case of metal in a coherent form

*Terracotta* is made from special clays which can be moulded by hand into elaborate forms before firing and very beautiful work is done in this material which after firing has great mechanical strength and permanency and is not excessively porous

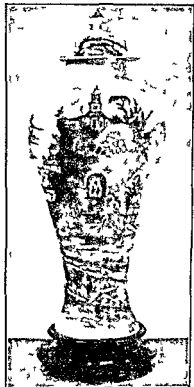
The drying of ceramic ware before firing requires great care to avoid cracking it is nowadays mainly carried out by heating in a tunnel. The heating has to be gradual and it is necessary that the evaporation of the moisture should not take place rapidly until the goods are well heated right through

The firing of the ware takes place in kilns the most modern of these being built for continuous operation in the form of a ring the point of highest temperature moving continuously round the ring at a rate depending on the time necessary for firing At the

the air passes round one side of the kiln and the hot gases round the other



Salt Glaze Spill vase painted in blue. Milled



Worcester Porcelain vase

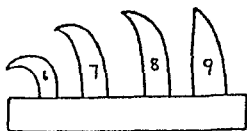
for the highest temperatures required for porcelain intermittent kilns are still employed especially where the output is not sufficient to allow of the use of a continuous kiln

The decoration of ceramic ware is of two principal kinds *under glaze* and *over glaze*. In the first the colours are applied to the unglazed ware by means of a brush spray or transfer. They then require to be fired before glazing as the medium used would interfere with this operation and hence must be destroyed by heat. The colours

opposite side of the ring a section is being unloaded and re-charged while



used are limited by the fact that they must resist high temperatures and the subsequent process of glazing. Overglazed decoration consists in painting on colours mixed with glaze with a low melting-point, the resulting decoration is not so permanent, but the range of artistic possibilities is much greater.



Seger Cones

One of the most important factors in ceramic work is the temperature to which the ware is raised during excavations. Long before the scientific measurement of high temperatures was possible, the invention of the *Seger Cones* by the German ceramic expert H Seger (1839-93), enabled the potter to measure temperature on an arbitrary scale, determined by the softening under heat of a cone of ceramic material of a certain composition. These cones are made so that they soften and bend over when they reach temperatures which differ by about  $20^{\circ}\text{C}$  from one another. They can be observed through a small hole in the furnace, but they can also be traced in parts of the furnace which cannot be seen, and the distribution of temperature thus checked. In the figure cone No 6 (softening at  $1200^{\circ}\text{C}$ ) has collapsed completely, cone No 7 (softening at  $1230^{\circ}\text{C}$ ) has bent over, No 8 (softening at  $1250^{\circ}\text{C}$ ) is slightly affected, while No 9 (softening at  $1280^{\circ}\text{C}$ ) is unaffected. Such a row of cones warns the potter that the temperature is approaching the required degree. (For other methods, see TEMPERATURE, MEASUREMENT OF.)

Regarding the subject from the historical standpoint, the pottery of the pre-Christian era was nearly all produced in countries situated around the E Mediterranean, e.g. Crete, Greece, Egypt, Mesopotamia, and for this reason there is a certain interchange of methods of production, and style of colouring and decoration.

*Egyptian Pottery*, owing to the extreme age and high development of Egyptian civilisation, shows great variety and a high standard. Perhaps the most characteristic feature is the blue glaze found noticeably on ushabti (small figures found in tombs), at its best a fine peacock-blue. It was also used in making beads, and some charming necklaces have been found during excavations.

*China* Undoubtedly the world's finest porcelain comes from China. Porcelain differs from all other forms of pottery in that it is white right through and also fired at a much higher temperature, which produces vitrification. "Egg-shell" porcelain is almost transparent, while crackleware shows a network of minute cracks under a clear glaze.



Delphi large vase with Arins of the Apo'hecarles Co

Many of the colours employed by Chinese potters have baffled all attempts at reproduction by their European rivals.

*Greek Pottery* is the most widespread of all, specimens having been found around the whole of the Mediterranean.

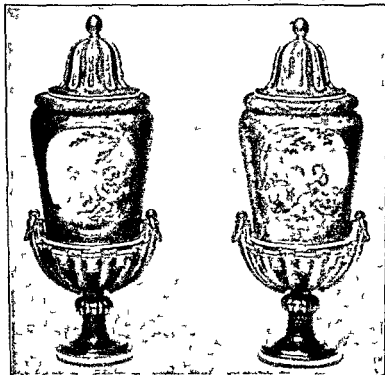
shores and even on the sites of Greek settlements in the Crimea. These specimens cover a period of nearly 3000 years.

*Roman Pottery* developed from the Greek. The common Roman ware usually known as *Samian* a light red with a smooth glaze and very little decoration was very widespread. Many specimens have been found in England most recently during excavations at St Albans.

After the fall of the Roman Empire all the arts received a severe setback and nearly 800 years pass before we find pottery of anything but a very coarse character.

Chinese porcelain then began to be brought to Europe and so far advanced was it that for many years European potters concentrated on trying to discover the secrets of its manufacture and to reproduce the perfect colours and glazes. In certain directions despite their best efforts they never succeeded.

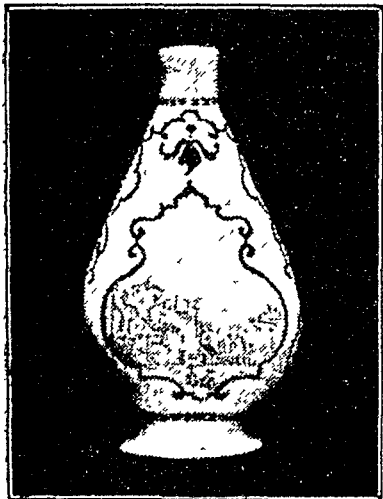
*English Pottery making* was first established on a considerable scale in N Staffordshire as the local clay was very suitable. From the middle of the 18th cent the industry developed fast and such great improvements were made in technique that English domestic pottery was exported all over



Sevres Porcelain Vases. Covers painted with children on green blue and gold *en de-parden* ground.

Europe. By the end of the 18th cent what might almost be termed mass production was in operation

Sèvres, and pottery for everyday use is steadily improving in colour and design



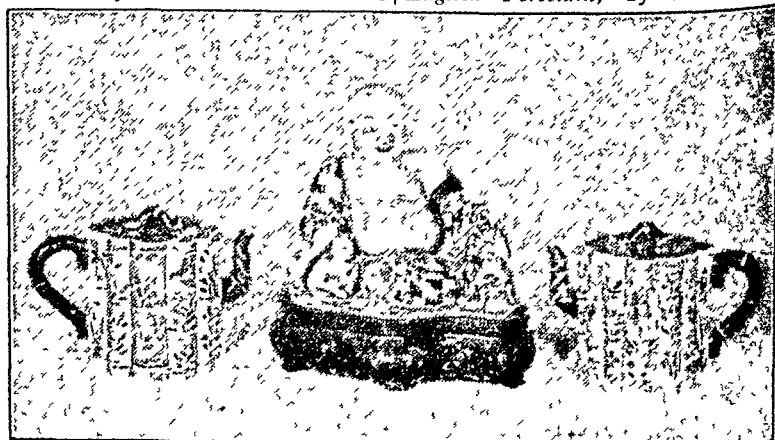
Bristol Porcelain Bottle

Many of the big potteries established in the early 18th cent continue to

BOW	BRISTOL	CAUGHLEY	CHELSEA
	COALPORT		
	Dale		
CHELSEA DERBY	COALPORT	DERBY	LONGTON HALL
NANT GARW			
NANT GARW C.W.		P:PN	
NANTGARW	NEWHALL	PINXTON	PLYMOUTH
Brameld	Spode	SWANSEA	W W
	SPODE		
ROCKINGHAM	SPODE	SWANSEA	WORCESTER

Porcelain Marks

CONSULT *Analysed Specimens of English Porcelain*, by Eccles and



Pair of Kang Hsi Teapots and Figure of Pu tai Ho-shang

produce fine ware, such as Royal | Rackham, *Chinese Porcelain*, by Gover Worcester, Royal Copenhagen, and | and Blacker, *Collecting Antiques*, by

W G Menzies *The Clayworker's Handbook* (1921) by Alfred B Searle

*Chief European Porcelain and Pottery Manufactories of the 18th Century*

ENGLAND Wedgwood Bristol Coalport Derby Worcester Bow Caughley Spode Minton Chelsea

FRANCE Sèvres Chantilly

GERMANY Dresden Meissen Berlin

HOLLAND The Hague

DENMARK Copenhagen

*Chief Periods of Chinese Porcelain*

Sung (900-1279)

Ming (1368-1644)

K'ang Hsi (1662-1722)

Ch'ien lun (1736-95)



Bow Fugue 1 Aut. min.

**Cerberus** [sɛ ˈbɜːrʊs] legendary three headed dog who guarded the gates of Hades Visitors to Hades had



Cerberus

to overthrow him (as did Hercules) or tempt him with meat or cakes (as did Ene.) before they could enter Orpheus charmed him with the music of his lute

**Cerdic** (d. 534) according to the Anglo-Saxon Chronicle Nennius and Bede was the first King of the W Saxons He is said to have landed in 490 and after many battles became king in 519 Most of the early Kings of England traced their descent from him

**Cereals** are grasses whose grains are used for food The table on p 40 shows the most common types with their food value (approx)

**Food Value** It can be seen from the table that cereals contain a certain proportion of the three main food groups Cereals are however with the exception of oatmeal and wholemeal wheat flour somewhat poor in protein and fat The blood and body building salts are present in the outer layer of the grain kernel

	Per cent protein	Per cent fat	Per cent starch	Per cent ash	Per cent water
Oatmeal	12	8	70	3	8
Wheat flour	11	1	76	0.5	11
Wholemeal flour	12	2	72	1.5	12
Pot barley	7	1	80	1	11
Rice	7	5	81	5	11
Macaroni	12	—	76	5	11
Tapioca	—	—	68	—	12
Semolina	11	1	78	5	11
Arrowroot	—	—	86	—	13

Cereals, such as wholemeal, or oatmeal, which retain this outer coat, are rich in mineral matter, whereas refined cereals, such as rice and white flour, are poor in this respect. Vitamin B is present in the germ and bran of cereals, and the yellow varieties contain appreciable amounts of Vitamin A. They provide the chief source of starch in the diet and are therefore of great value, provided that fruit and vegetables are included in the diet to counteract the effects of their acid residue. The germ, however, contains substances called "toxamins," which act as poisons, unless sufficient quantities of Vitamins A and D are consumed to counteract them.

*Method of Cooking* varies according as to whether the grain is whole, ground, or crushed. If whole, it is baked in milk, or sprinkled into boiling water or milk. The larger grains, such as sago and tapioca, which are not easily penetrated by liquid, are frequently soaked for an hour or two before cooking.

Ground or crushed grains, such as ground rice, rolled oats, cornflower, and hornwing (maize) are usually made into a paste with cold water, boiling water poured on to them, and the whole returned to the saucepan to boil. If eggs are used, they should always be added after the cereal has been boiled. Rice, or other milk puddings, are best if cooked in a double saucepan before baking.

*The quantity of cereal* is from 1 to 2 oz per pint. The following are typical recipes.

### Rice Pudding.

1½ oz rice  
1½ oz sugar  
1 pint milk

Nutmeg, vanilla, or lemon flavouring  
Mix ingredients in pie-dish, and put in moderate oven (320° F) for 2-3 hours, being careful not to spill the milk over the pie-dish.

### Rice for Curry

4 oz Patna rice (1 oz per person)  
About 3 pints boiling water  
1½ tablespoonfuls salt

1 teaspoonful lemon juice

Sprinkle rice in boiling salted water to which lemon juice has been added. Boil until tender (about 15-20 minutes). Strain, and pour cold water. Place sheet of greased paper or clean cloth on a baking tin. Put rice on this and place in a warm oven, turning from time to time with a fork. Serve when dry, and the grains are separate.

### Porridge

1½ oz oatmeal (medium)  
½ teaspoonful salt.

1 pint boiling water

Sprinkle oatmeal into salted boiling water, and attempt to prevent lumps from forming. Boil for 5-6 minutes, stand in boiling water (or double saucepan), and cook for 1 hour.

### Chocolate Mould

2 oz cornflour

1 oz sugar

1½ oz chocolate

1 pint milk

2 tablespoonfuls milk for mixing chocolate

Pinch of salt

Grate chocolate or cut in small pieces. Dissolve in warmed milk. Mix cornflour to a paste with some cold milk. Boil remainder of the milk, pour on to dissolved chocolate, and add the mixture to blended cornflour. Return to saucepan and boil for 5-10 minutes. Pour into a wet mould.

A plain mould can be made in a similar way, omitting the chocolate flavouring.

*Cereal Foods* A large variety of cooked and semi-cooked cereals are

now manufactured for use as break fast food. In some of these the starch which forms the main constituent of all of them has been partially cooked. It is then necessary to finish the cooking before they are consumed. In others the starch has been completely cooked to a crisp form and these foods are essentially similar in nature to biscuits. A further variety is produced by first acting upon the starch with *malt* which is mixed with the moist grain and partially converts the starch into sugar.

**Ceres** [SER EZ] Roman goddess of harvests and cereals (to which she gave her name) equivalent to the Greek Demeter daughter of Saturn mother of Proserpine (q.v.). She instructed mankind through Triptolemus in all the arts and sciences of agriculture. She especially patronised Sicily to the inhabitants of which she also taught the arts of government. To her were offered the first fruits of the harvest. See also DEMETER.

**Ceresin**, a mineral wax obtained by the purification of ozokerite (q.v.) by treatment with sulphuric acid followed by bleaching over charcoal. This gives a white product with a melting point of about 70 C. It is used for numerous purposes such as the manufacture of polishes, candle manufacture, sizes, fillers, etc. Bottles for transporting hydrofluoric acid (which attacks glass) are made from ceresin.

Chemically ceresin is not a wax since it consists almost entirely of the higher hydrocarbons and does not contain any appreciable amounts of esters. It is similar to paraffin wax.

**Cerium**. For the characteristics of cerium see the article ELEMENTS.

Cerium is a metallic element belonging to the group of rare earths of which it is the commonest. It occurs in a number of minerals the principal of which is *monazite* a mixed phosphate of cerium and thorium which is found in large amounts in Brazil, Ceylon and parts of the United States. It is used to a considerable extent for the

manufacture of pyrophoric alloys. The dioxide is utilised in the manufacture of gas mantles and is applied by igniting (on the mantle) one of several cerium compounds.

**Certified Cheque** cheque which a banker has certified will be paid on presentation. If it is not met the holder can sue the banker but not the drawer.

**Certiorari**, a writ issuing from the King's Bench Division addressed to the judge or officer of an inferior court ordering him to certify or to return the records of a cause pending before them to the end that justice may be done. It lies to remove into the King's Bench Division all indictments, coroners' inquisitions, summary convictions by magistrates, orders of removal of paupers and of poor rates, orders made by commissioners of sewers by town council and railway companies for the purpose of being examined and quashed if necessary. It may be obtained by leave of the court by prosecutor or defendant and is available in all cases even those in which an ordinary appeal is not available.

**Cervantes, Saavedra, Miguel de** (1547-1616) Spanish author the son of an apothecary. He enlisted in the army in 1570 and took part in the battle of Lepanto (1571) where his left hand was maimed. Returning home from Naples in 1575 he was captured by Barbary pirates and remained a slave in Algiers until 1580. From 1582 to 1587 he wrote many plays of the sword-and-cloak variety but he did not become well known until the publication in 1590 of his *La Galea* an artificial prose pastoral. He was extremely poor and was frequently imprisoned for debt. *Don Quixote* (1605) considerably improved his circumstances. Of his other works the



Miguel de Cervantes.

*Novelas Ejemplares* (1613) alone deserves mention

His reputation to-day rests almost solely on *Dor Quixote*, one of the best and most popular novels of all time, for vivid characterisation and subtle humour, it remains unsurpassed. It contains many witty Spanish sayings quite lost in the English translation

**Cesarewitch**, see HORSE-RACING

**Cessio Bonorum**, in Roman, Scottish, and certain continental systems, of law, a surrender of goods by a debtor to his creditor in complete or part discharge of the debt

**Cestui que Trust**, legal term denoting the beneficiary under a trust (*qv*)

**Cestus**, see BOXING

**Cetacen**, see WHALES

**Cetin**, a popular name for *cetyl palmitate* (*qv*)

**Cetinje**, former capital of Montenegro and now of the banovina of Zetska (Yugoslavia), situated in the S, not far from the coast. The town is small, but of considerable historic interest. It contains the old Montenegrin Royal Palace, and is in communication with Rijeka, a small port on Lake Scutari, it was founded in the 15th cent by Ivan the Black. Pop c 5000

**Cette**, French port on the S coast in the department of Hérault, where it is second in commercial importance to Marseilles. Pop 36 000

**Cetus**, see CONSTELLATIONS

**Cetyl Palmitate**, or *cetin*, is the principal constituent of spermaceti (*qv*) which is obtained from the head of the sperm whale. It is occasionally separated from the other constituents of spermaceti by extraction with alcohol, and is used as a base for ointments and in the manufacture of candles and soaps

**Cetywayo** (c 1826-1884), Zulu king succeeded his father 1872, and adopted a menacing attitude towards British interests in Natal. Defeated and captured by the British, 1879, he was later re-established in part of his kingdom, but was pursued by former tribal opponents and died in hiding

**Ceuta**, Spanish fortified port in Morocco, on a promontory opposite Gibraltar. At the end of the promontory is a peak (635 ft.), once known as one of the "Pillars of Hercules". Ceuta stands on the site of a Carthaginian settlement, and has been held by the Romans, Vandals, Byzantines, and Arabs. It became Spanish in the 17th cent. Pop 25,500

**Cévennes**, chain of mountains, with several variant local names, in the S E of France, stretching some 300 m N from the plain of Languedoc. They form a part of the S E edge of the central plateau, and are the watershed between the R Rhone on the E and the Garonne and the Loire on the W. The chief peaks are Mézenc (5700 ft) and the Pic Finiels (5500 ft). The S and W slopes of the hills are very fertile, and produce fruit and grapes; in other places there is excellent pasture, and large flocks of sheep are reared. The minerals are coal, manganese, and some iron

**Ceylon**, island, forming a British Crown Colony off the S extremity of India, lying in the Indian Ocean, and separated from the mainland by Palk Strait and the Gulf of Manar. Its length is 270 m, and its greatest breadth, 138 m, the area is 25,300 sq m. The coast is indented with numerous small bays and lagoons, and to the N W are dangerous sandbanks and shoals, notably those forming "Adam's Bridge" between the island of Manar, and the Rameswaram peninsula of the Indian mainland. Geologically the island consists of a great core of crystalline rocks, which are most notable in the high lands of the middle S, forming the peak of Pidurutalagala, and Adam's Peak. In the N, around the coasts, decomposition has taken place, and the rocks are overlaid with a thick section of laterite, and with sand and alluvium. The principal rivers are the Kiargal Ganga, and Mahaweli Ganga, and many small streams flow from the mountains towards the coasts, drying up in the extreme

summer. The climate is marked by the monsoons the S.W. in May which affects only the S.W. part of the island and the N.E. in late Oct. which owing to the more gradual rise of the land affects the whole island. The summer months are extremely hot except in the mountains.

Agriculture employs practically all the available labour and the most notable exports are tea, rubber, coffee, rice, coconuts and their products, cinnamon and tobacco. The only manufactures are those such as copra which arise out of the agriculture. There are valuable deposits of plumbago (graphite) and some precious stones, mainly sapphires are mined. The chief towns are Colombo the capital, Kandy, Jaffna, Galle, Hambantota and Batticaloa.

Of the several native races the Sinhalese are numerically the greatest and then come the Tamils and the Moormen, the principal religion is Buddhism and others are Hinduism, Mohammedanism and Christianity.

Ceylon was known to the Greeks and the Romans and possesses an account of its own history the *Malala* which dates back to the 5th cent. B.C. In more recent times it was first visited by the Portuguese in the early 16th cent. and colonised largely for commercial profit without consideration of the natives. The Portuguese were dispossessed in the middle years of the 17th cent. by the Dutch who were more successful in their administration. In 1793 the colony was attacked by England and formally ceded to her in 1802. Under English rule tea and rubber were introduced and the wealth of the island grew towards its present considerable dimensions. Government is carried out by a Governor assisted by an elected State Council of 46 members and for local government the island is divided into 9 provinces each administered by a Government Agent. Pop. 5,300,000.

**Céranno** (pron. sĕ-AN) Paul (1839-1906) French painter born at

Aix, early formed a great friendship with Zola and in 1863 followed him to Paris. He became associated with the impressionist group.

His early works are dramatic and violent in treatment and rather heavy in colouring. It was not until after he was 30 that he became interested in colour and light. He worked with his art for a time at Annecy-sur-Ouche and his landscapes of this period (1875-83) are atmospheric and impressionist in treatment while continuing to recall clearly his main preoccupation with the problems of rhythm, three-dimensional design. He brought extraordinary endeavour and persistence to each of his portraits, working out his sitters with the demands he made on them and frequently abandoning or destroying his canvases after months of work.

He lived in obscurity at Aix for the greater portion of his life and it was not until an exhibition of his paintings was held in Paris in 1904 that recognition came at last from those best qualified to judge. Since his death his reputation has steadily increased until to-day he is acknowledged as one of the most important figures in the modern history of art. His portraits of himself and of Mme Céranno, his landscapes, his *Deuses* and his *Card Players* are known to all students of modern painting while his water-colour drawing indicate in a surprising manner his mastery of form expressed with the greatest simplicity of means.

**Chaco** district in the N. of Argentina part of Gran Chaco. It lies S. of the Bermejo R. and Santa Fé is its southern boundary. Much of the region is covered with valuable timber and in the N. are plains where great numbers of cattle are reared and agriculture is carried on. The capital is Resistencia. Area 52,500 sq. m. pop. 58,500.

**Chad, Lake** a large lake in the N. of Central Africa on the N.F. border of Nigeria. The lake is divided by



marshes into a N and a S. area. There are numerous small islands, the depth varies between 5 and 20 ft. In time of rain the shores are flooded, but the lake is steadily shrinking, although it still covers about 7000 sq m. The Shari, Yedseram, Waube, and other rivers flow in, but there is no outlet. The shores are divided between Great Britain and France.

**Chad, St** (fl 7th cent.), Saxon Saint, Bishop of Northumbria in 664 and later of Lichfield. Bede mentions a convent he founded at Barrow-on-Humber, Lines. He died in 672. Feast, March 2.

**Chæronea**, historic Greek city of Boeotia, near the modern village of Kaprانا. It is noted for the two famous battles fought there between Philip of Macedon and an alliance of Greek States (338 B.C.), and between the Roman Sulla and Mithridates (86 B.C.). Among the archaeological remains are the Greek theatre, the ruins of the temple, and a great stone lion which marked the grave of the soldiers who fell in the battle of 338. Chæronea was the birthplace of Plutarch.

**Chafing dish**, kitchen utensil used for keeping food hot. Some have a compartment underneath, which is filled with boiling water, others are heated by means of a small methylated flame. The modern tendency is to use an electrically or gas-heated hot-plate instead.

**Chagos Archipelago**, a group of small islands in the Indian Ocean, S. of the Laccadive group. They are British territory, administered from Mauritius. Diego Garcia, the chief, is a coaling station for the Australian and Red Sea routes. There is a considerable production of coconut oil, and smaller exports are copra and coconuts. Area, 150 sq m., pop. 1300.

**Chain**, a series of connected links joined together in such a way as to be capable of relative motion, and of sustaining tension. Chains are used, (1) to sustain tension, (2) to drive suitably clogged wheels, and (3) for ornament, when the links are

decorative. Chain of the first class is made up to very large sizes, the largest being the anchor chains of ships, and for an infinite variety of purposes down to chains of extreme fineness used in watches and scientific instruments, such as aneroid barometers. Wrought iron, welded by hand, is used for anchor and other large chains where the highest demands are made on reliability and strength. Smaller chain, up to c. 1 in. in diameter, is now made by electrical welding, the link being formed from wire or rod by a machine, which delivers a continuous chain to the welding apparatus. The method of electrical welding is similar to that used in other types of welding (*qv*). Links employed for these chains are of various proportions and designs, simplest and commonest being an oval. By twisting each link the chain may be made to lie flat. Chains are also made with a bridge or "stud" across each link. This is of no advantage from the point of view of strength, but tends to prevent kinking, and hence such chains are used for ship's cables.

Driving chains are used in a great variety of forms, most familiar being the ordinary bicycle roller chain. Here the chain is formed by two parallel chains of flat links joined by cylindrical cross-pieces carrying rollers. The rollers, not being worked upon in any way, may be of very hard steel, and this type of chain is now being used more and more to replace other methods of power transmission. The *silent chain* consists of flat C-shaped links riveted together to form, when they are curved round the cog-wheel, a kind of internally toothed gear wheel. They may be of any width, and will transmit high powers at high speeds between centres much closer together than would be possible with belts. While the above types are the only ones suitable for power transmission of a high class, various other chains may be run over suitably shaped wheels to serve special purposes. Simple cable chain is thus frequently used under very dirty conditions where



CHINESE INCENSE BURNER

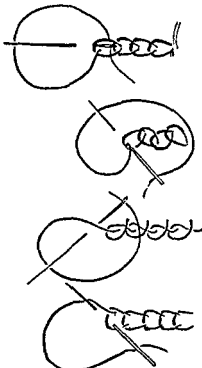


CHINESE IMPERIAL ROBE  
(Embroidered dragons 19th century)

roller or other more elaborate chains might be completely ruined by rust

**Chain Conveyor** see CONVEYOR

**Chain Stitch**, simple embroidery stitch used for both outline and filling employed a great deal in the old smock patterns and in quilting and tapestry embroidery. The illustration shows some simple chain stitches



Chain Stitch.

**Chain Stores** groups of retail shops of the same character under unified control. The system affords simplification in large scale buying distribution of management costs centralisation of stocks and often leads to units of manufacture and production being added to the retail business

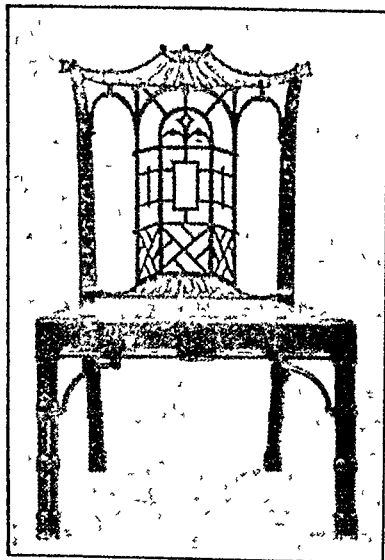
**Chair** a seat for one person. The chair is extremely old but until the 16th cent was used only by persons of authority. In Ancient Greece and Rome chairs were of marble often with elaborately carved arms but no backs. Later metal and wood were used with leather strips for a seat. A George I mahogany and chair wooden chair (17th cent) in St Peter's Rome appears to



Hippelwhit in boggy y b i satinwood w th cen re medallio

belong to the 6th cent AD a marble one in Ravenna Cathedral is

of the same period. In the early Middle Ages, Lords of the Manors used chairs with a canopy and with their armorial bearings carved on the back. After the Renaissance chairs began to be used as ordinary furniture, not as seats of honour. Wood, with leather, brocade, damask, cane, and rushes, has been used right up to the present day, and the main styles—Jacobean, Sheraton, Chippendale, Louis Seize—are still reproduced.



Chinese Chippendale

widely. Modern forms are the heavily upholstered arm-chair with loose cushions, and the office chair of light stainless steel.

**Chairman** The person who presides over the conduct of a meeting of any assembly, committee, or company. A meeting cannot go forward without someone in the chair, who may either hold the position by statutory right or be elected thereto. The Chairman of the House of Commons is elected at each new Parliament, and is known as the Speaker. The chairman's duties

are to maintain order, to procure the decision of questions by vote, to call upon speakers to address the meeting, and to ensure that a proper record (the minutes) be kept, which is signed by him. See also CASTING VOTE.

**Chairs, to Repair, see REPAIRS, HOUSEHOLD**

**Chalcedon**, historic town in Asia Minor, nearly opposite the city of Byzantium, successively held by Greeks, Romans, Persians, and Turks. The Council of Chalcedon, which condemned various heresies in the 5th cent., took place there.

**Chalcedon, Council of**, the fourth Œcumenical Council of the Christian Church, held in A.D. 451. Although presided over by Papal legates, it was mainly composed of E. prelates. It marked a definite stage in the development of Christian doctrine by rejecting both the Nestorian heresy (which over-emphasised the manhood of Christ) and the Eutychian doctrine (which denied it) and by the affirmation of the dual aspect of Christ as God and man. For the rest, it was concerned with questions of discipline, monastic celibacy, etc. It upheld a decree of the 2nd council giving the see of Constantinople equal privileges with Rome. This last decision was rejected by Pope Leo I, but was accepted in the East.

**Chalcedony**, non-crystalline silica with a tendency towards crystallisation. Sometimes it is regarded as a mixture of quartz and opal. Its colour is variable, and it usually has a waxy surface. Frequently it fills cavities in rocks or in flint nodules. Carnelian is a real translucent variety of chalcedony, often set as an ornamental stone in rings, and used by the Egyptians as far back as 2000 B.C., and later for their scarabs. Bloodstone is green chalcedony spotted with red jasper, traditionally the blood of Christ. Onyx and sardonyx are banded chalcedony, used for cameo work, and agate (qv) is well known as a gem-stone.

**Chalcis**, Greek capital of the isle of

Euboea on the Strait of Euripus in the 7-6th cent B.C. founded a number of cities in the Chalcidice Peninsula and Sicily. It was conquered by the Athenians and held by Philip of Macedon. It was prosperous under the Romans and was held subsequently by the Venetians and Turks until finally restored to Greece (1830). Its church dates from the Byzantine era. Chalcis is the export centre for the island. Pop. 12,000.

**Chalcocite** *see* COPPER

**Chaldeæ**, Biblical name for Baby-lonia more strictly applicable to the extreme S. territory whose capital was Bit Yakin. By aggression inter-marriage and territorial encroachment the Chaldeans gradually became supreme throughout Babylonia reaching the height of their power in the reigns of Nabopolassar and his successors. The name Chaldean is used in the book of Daniel and by several classical authors to mean an astrologer or magician (*see* UR OF THE CHALDEES).

**Chalfont St. Giles**, Buckinghamshire village 3 miles S.E. of Amersham. Milton lived here for a year and wrote parts of *Paradise Lost* and *Paradise Regained*. His cottage is still standing. Wm. Penn is buried in the Quaker cemetery at Jordans near by. Pop. 2,000.

**Chalgrove**, village in Oxfordshire 10 m. from Oxford scene of a defeat of Cromwell's troops by Prince Rupert in which Hampden was fatally wounded (18 June 1643). Pop. 500.

**Chaliapin** [*pron* SHALYAPIN] Fyodor Ivanovich (b. 1873) Russian bass operatic singer. Born at Kazan he became the idol of the Russian musical public soon after his first appearance in St. Petersburg (Leningrad) in 1894. He made his English debut at Drury Lane in 1913 when the remarkable beauty of his singing and his powerful and original acting made a profound impression. He became exceedingly popular in Great Britain as a concert artist on his return after the World War and appeared at Covent Garden

in Ballo e Mefistofele. Rossini's *Barber of Seville*, Gounod's *Faust* and Mussorgsky's *Boris Godunov*. He has also appeared in Pabst's film *Don Quixote*.

**Chalice** the cup which holds the wine in the celebration of the Holy Eucharist often a very costly and beautiful vessel. In Greek Roman and Coptic practice chalices are consecrated. Famous in mediæval legend was the Holy Grail (*qv*) said to be the chalice used by Christ at the Last Supper.

**Chalk**, a soft light-coloured pure limestone of very uniform character deposited over a wide area of Europe towards the close of the Cretaceous period.

Chalk is divided into Lower Middle and Upper. The Lower sometimes known as Grey Chalk contains a fair proportion of clay material which gives it the grey colour. Middle chalk contains less clay and Upper chalk is the well known White Chalk in which occur most of the concretions of silica called flints (*qv*). Chalk may be soft or hard in texture and may contain small grains of various minerals such as phosphates or glauconite. It is extensively quarried for the manufacture of lime and Portland cement the annual output in England being approximately 5 million tons. Hard bands in the chalk are used as building stone. Other uses are for the manufacture of whiting and of Paris white used in wallpaper oilcloths etc. It is also employed as a fertiliser. *See also* CRETACEOUS SYSTEM.

**Chalk or Crayon Engraving** *see* ENGRAVING

**Challoner** Richard (1691-1731) an English Roman Catholic prelate. Ordained priest at Douai France (1716) he was sent to England in 1730 and made Bishop of Debra (1741) and vicar-apostolic of the London District (1743). He was famous as a polemicist and he published *Memoirs of Missionary Priests* an account of the English Catholic martyrs of the 16th and 17th cents. and other works.

**Chalmers, Thomas** (1780-1847), Scots minister who made his name first as lecturer in mathematics at St Andrews University. In 1815 he was appointed to the Tron Church of Glasgow, where he experimented in parish organisation, particularly in the direction of education and poor relief. In 1823 he was appointed Professor of Moral Philosophy at St Andrews, and published several books, including one on Political Economy. In 1841 he was the leader of the Free Church of Scotland Movement (*qv*).

**Chalone**, *see* HORMONLS

**Châlons-sur-Marne**, French town, capital of the Marne department, situated 30 m SE of Reims. The town is noted for its champagne. On a plain near by the Battle of the Catalaunian Plains took place in 451, wherein the Romans under Ætius and the Visigoths under Theodore defeated the Huns under Attila, thus checking their advance into Europe. There are a 13th-cent cathedral and several ancient churches. The Germans occupied Châlons-sur-Marne in 1870, and again for a short period in 1914. Pop 31,200.

**Chalon-sur-Saône**, manufacturing town in department Saône-et-Loire, France, on the R Saône, 75 m. N of Lyons. The chief products are iron and steel goods, copper, tiles, and glass. There is considerable trade in timber and wine. Notable buildings are the old cathedral (13th cent), the bishop's palace, and a 15th-cent bridge over the river. Pop 31,600.

**Chalybite** is iron carbonate, and a valuable iron ore. It is found massive, or in clusters of small greyish brown crystals, and is liable to oxidise into limonite (*qv*). It may be formed as a direct precipitate, as in coalfields, or it may result from the replacement of the calcium carbonate in a limestone by iron carbonate, as in the well-known Cleveland iron ore of Yorks. Deposits are worked in Germany.

**Chamba**, Indian State of the Himalayas, in the Punjab, S of Kashmir Area, 3200 sq m, pop 142,000.

**Chamberlain, Arthur Neville** (b 1869), British politician, son of Joseph Chamberlain (*qv*), Lord Mayor of Birmingham, 1915-16, MP (Conservative), 1918, Postmaster-General 1922-3, Minister of Health, 1923-1924-9, Chancellor of the Exchequer



Neville Chamberlain

1923, and again from 1931. He was responsible in 1926 for the Rating and Valuation Act, and, as Chancellor of the Exchequer in 1932, for the general introduction of tariffs.

**Chamberlain, Sir [Joseph] Austen, KG** (b 1803), British statesman, eldest son of Joseph Chamberlain, educated Rugby and Cambridge. MP for E. Worcestershire, 1892-1914, and for Birmingham West from 1914 onwards. Between 1895 and 1906, Chamberlain was successively Civil Lord of the Admiralty, 1895, Financial Secretary to the Treasury, 1900-2, Postmaster-General, 1902-3, and Chancellor of the Exchequer, 1903-6. He became a leading Unionist during the Liberal administration, was Secretary of

State for India in the Coalition Cabinet 1915-17 he was again Chancellor of the Exchequer 1919-21 Lord Privy Seal 1921-2 As



Sir Aust Chamberlain.

Secretary of State for Foreign Affairs 1924-9 Chamberlain negotiated the Locarno Pact 1925 advocated German membership of the League of Nations 1926 and strongly supported the League

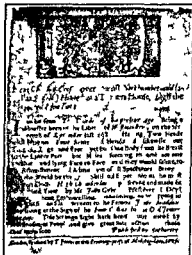
Was First Lord of the Admiralty 1931 As a National member since 1931 Chamberlain has advocated housing reforms and has followed foreign affairs closely

Chamberlain, Joseph (1836-1914) British statesman educated Canonbury and London made brilliant success of screw manufacturing in Lunningham retired early and interested himself in local and national politics Mayor of Birmingham 1873-6 he carried through housing reforms and slum clearances and introduced adequate municipal gas and water supplies Holding radical political views Chamberlain was M.P. for Birmingham 1876 and President of the Board of Trade under Gladstone 1880 He was President of the Local Government Board but resigned and was instrumental in overthrowing the Government on their Irish Home Rule Bill 1886 Chamberlain strenuously opposing coercion Was Colonial Secretary 1895-1903 working for Imperial economic co-operation and facilitating amicable settlement after the Boer War Tariff Reform Imperial Preference and colonial development schemes occupied him during all his term as M.P. but after 1906 he took no share in active politics though he re-

tained his seat in Parliament from 1885 till his death

Chamberlain an officer attached to the Court of a monarch to control all domestic and ceremonial duties and to supervise all other palace officials servants and purveyors Originally an ex officio member of the governmental council his responsibilities gradually diminished See also CEN SORSHIP

Chamberlen Family of The two sons of a Huguenot refugee physician Peter



the younger (d 1676) and Peter the elder (d 1631) who specialised in obstetrics and are credited with the application of the forceps to operative infant delivery c 1590 This invention contrary to medical custom they kept secret and attempted to corner the market claiming that they could deliver a patient when all others failed The secret was still jealously guarded by a further Peter Chamberlen (1601-63) physician to King Charles II and by his sons of whom Hugh was the most active Hugh Chamberlen began to advertise and published a handbill as follows Near Charing Cross



over against Northumberland (*alias* Suffolk) House, at a Turners House, near the Golden Lion Tavern, is to be seen, the Wonder of this Present Age, being a monster born in the Liberty of Westminster having two heads, with hair on, four arms and hands, as likewise four thighs, legs and feet yet but one body from the breast to the lower part brought into the world by the great skill and experience of the most famous Doctor Hugh Chamberlain " This paper (reproduced on p 429) was issued under the Royal Arms The monster either grew in the imagination of the " Famous Doctor " or was synthetic Hugh Chamberlen dabbled in politics and was forced to escape to Paris, where he attempted to sell the family secret, contrary to medical ethics He agreed to sell it to a Medical School in Amsterdam, but gave them half the instrument only Eventually, however, the secret leaked out, and the instrument soon came into general use The invention of the forceps is usually attributed to Jern Palfyne, a Belgian, who was probably impressed by the half instrument sold in Holland, developed the second side, and freely presented the complete forceps to the Paris Academy in 1721

#### Chamber Music, *see* Music

**Chamber of Commerce**, an association of merchants, bankers and citizens, with the object of promoting trade and commerce Chambers of Commerce may appeal for Governmental trade protection, supply trade statistics, settle commercial disputes, offer technical advice, and generally subserve merchant interests A Chamber of Commerce was established at Marseilles in the 14th cent, and the system was common in France in the 18th The oldest British chambers are those of Jersey (1768), Glasgow (1783), Dublin (1785), Edinburgh (1786), and Manchester (1794, reorganised 1820) The London Chamber of Commerce, which was founded as late as 1881, is now a huge organisation with 8,000

individual members and over 50 affiliated organisations Its work, being highly technical, is divided among 69 sections devoted either to the specific countries traded with or to the goods or commercial processes concerned Special departments represent merchandising, manufacturing, banking and insurance interests A court of arbitration is administered jointly by the London Chamber of Commerce and the Corporation of London, to appoint arbitrators for the settlement of trade disputes Similar courts exist in Manchester and Dublin Another function of the Chambers is the maintenance of a high standard of commercial education, and in London and other cities examinations are periodically held, in which about 14,000 certificates and several scholarships are awarded annually Investigations are occasionally undertaken into the conditions in individual trades, and suggestions made for their reorganisation Sixteen British Chambers formed the Association of British Chambers of Commerce in 1860, and this organisation is to-day a thoroughly representative one The establishment of British Chambers of Commerce in the Empire preceded their general acceptance at home, New York—at that time a part of the Empire—(1768), Cape Town (1804), Calcutta (1834), Bombay and Madras (1830), Ceylon (1830), Adelaide and Jamaica (1840), and Toronto (1845), being the oldest Associations in the Dominions and India are now linked in the Imperial Federation of Chambers of Commerce There are also many British Chambers in foreign countries, which gather information, protect British commercial interests, and co-operate with the consular and diplomatic officers There are French Chambers in London and Liverpool Chambers of Commerce co-operate in the organisation of trade exhibitions, such as the British Industries Fair (*q v*), which provide a meeting-place for manufacturers and prospective buyers (*See* FEDERATION OF BRITISH INDUSTRIES)

**Chambers (law)** semi private rooms in which the judges or masters dispose of points of practice and other matters not sufficiently important to be heard and argued in court also applied to rooms or apartments especially the offices of a barrister

**Chambers, Ephraim** (c 1680-1740) the first important English encyclopaedist His *Universal Dictionary of Arts and Sciences* (1728) was translated into French and so became the basis of the famous *Encyclopédie* of Diderot and d'Alembert. See also *ENCYCLOPEDIA*

**Chambers, Robert** (1807-1871) Scots publisher and writer with his brother William (1800-83) founded (18 9) the firm of W and R Chambers which published many encyclopaedias and historical symposia partly done by Robert His works include accounts of the history and antiquities of Edinburgh and several geological treatises of some value

**Chambers, Sir William** (1 6-1 96) English architect remembered as the architect of Somerset House London An early voyage to the East brought him under the influence of Chinese art and it was largely owing to him that Chinese decorative ideas became so fashionable in England towards the end of the 18th century He laid out Kew Gardens and designed the pagoda there His *Treatise of Civil Architecture* (1759) is still widely used by students He was a foundation member of the Royal Academy

**Chambéry** French city capital of the Dept of Savoie a few miles S of Lake Bourget A popular holiday centre it has several notable buildings of which the ancient cathedral the Hôtel Dieu and the original portion of the castle are worth visiting There is a silk and leather trade Pop 23 400

**Chambord, Henri Charles Ferdinand Comte de** (18 0-1883) the eldest representative of the senior branch of the French Bourbons The French royalists called him Henry V and made several attempts to place him on the throne of France The royalists were divided some favouring the claims of the

Comte de Paris but in 1873 they united and with the support of the Premier and the neutrality of the French President it seemed as though they might be successful But Chambord would not promise to rule as a constitutional monarch and the Assembly finally decided in favour of a Republic

**Chameleons** (pro KAMP LYONS) a group of peculiar lizards found in the tropical countries of the Old World They are adapted to arboreal life having the tail prehensile and the feet peculiarly modified like a parrot's for grasping branches The body is flattened sideways and the eyes are prominent and highly movable

Chameleons feed on insects which



Chameleon.

they catch at a distance of several inches by striking them with their long elastic sticky tongues

They have the power of changing colour to match their surroundings by varying the arrangement of the different layers of pigment in the skin An extra development of the lungs enables the body to be inflated when the animals are fighting among themselves Some kinds are viviparous but they are mostly egg layers

The name chameleon is sometimes wrongly given to certain W Indian arboreal lizards which have a similar faculty for colour change but are related to the Iguanas

**Chamfort, Nicolas Sebastien Roch** (1741-1794) French man of letters famed for his witty conversation which made him welcome at Court and in

the Jacobin Club alike During the Reign of Terror he committed suicide The gems of his wit are recorded in his uncompleted *Maximes et Pensées*

**Chamois**, an antelope, as large as a goat, but with small upright horns, hooked at the tip It is found in the mountain-ranges of S Europe and in Asia Minor Owing to its wariness and activity it is attractive game to stalk and shoot Its hide, dressed and tanned, is the commercial chamois-leather, but sheepskin is often sold as such

**Chamonix**, a noted French tourist centre, in Haute-Savoie, near the foot of Mont Blanc There are several famous glaciers near by, including the Mer de Glace Pop 3800

**Champagne**, formerly a province, now a district, of France, including the departments of Marne, Ardennes, Haute Marne, and Aube, and parts of Aisne, Yonne, and Seine-et-Marne The name is derived from the Latin term for the chalk plains which make up much of the surface The famous champagne wine is produced here The province became united with the French crown in 1286

**Champaubert, Battle of** (Napoleonic Wars) (Feb 10, 1814) Napoleon I met and completely routed one of the divisions of Blücher's army while marching on Paris via Châlons On the following day (Feb 11) he defeated another division at Montmirail, on the 13th he defeated a third (30,000 Russians and Prussians under General York) at Château Thierry, and on the 14th at Vauchamps he encountered the main body under Blücher, which was compelled to retire

**Champerty**, see MAINTENANCE

**Champion's Hill**, see VICKSBURG

**Champlain, Lake**, in the N E of the United States, between New York and Vermont. It stretches N to S, and some 5 m at its N end are in Canada The lake is an important waterway for timber and coal Numerous skirmishes between French and Indians took place in the vicinity, and during the war of 1812-15 a small English fleet was

defeated by an American fleet on its waters Area, 500 sq m

**Champlain, Samuel de** (1567-1635), French founder of Quebec (1608) and first Governor of Canada while it was a French colony

**Champollion, Jean François de** (1790-1832), French Egyptologist, and first Professor of Egyptology in the *Collège de France*, 1831 He was the first to decipher Egyptian hieroglyphics

**Chancel**, that part of a Christian church which contains the altar at one (usually the East) end, and which is separated at the other end (sometimes by rails) from the nave (*q v*)

**Chancellor, Richard**, a Tudor sea-man who in 1553 held a command in Willoughby's expedition in search of the N E passage to the Indies He was separated from the main fleet, but found his way into the White Sea, and later visited Moscow, concluding a treaty, which opened up trade relations between England and Muscovy In 1556 he was drowned off the E coast of Scotland

**Chancellor**, an ancient official title whose significance varies in different periods and places In mediæval times, as royal secretary, with judicial, administrative, and ecclesiastical duties, the Chancellor received all petitions addressed to the King He therefore tempered the common law, administered equity, and possessed political power second only to that of the monarch The Lord High Chancellor to-day is the chief judge in England, sits in the Cabinet, and receives a salary of £10,000 a year He also presides over the House of Lords as Speaker, and appoints judges to the Court of Appeal, the High Court, and the County Courts The office of Chancellor of Scotland expired in 1707, and that of Lord Chancellor of Ireland in 1922 on the establishment of the Free State The Chancellor of the Duchy of Lancaster manages the Crown lands of the Duchy, which are spread over several counties, and is a member of the Ministry of Agriculture The Chancellor of the Exchequer,

whose office dates from the 13th cent is national Minister of Finance and has Cabinet rank. In Germany the *Reichskanzler* is Federal Minister of the Empire chief of Federal officials and initiator of foreign policy and in many ways corresponds to the Prime Minister in England.

The titular head of a university an office founded in medieval times by the Popes is also named Chancellor. He formerly had full power to make laws set studies appoint professors etc but to-day his activities are limited to the general protection of the interests of the university especially in connection with the government and in actual administration he is represented by a Vice-Chancellor.

**Chancery Division**, a Division of the High Court of Justice until 183 the Court of Chancery which alone administered equity (*qv*). It deals with the administration of estates of deceased persons dissolution of partnership taking of accounts mortgages trusts specific performance of contracts wardship of infants and almost all matters which could formerly be brought in the common law courts. It administers both equity and common law. Trial is by judge without a jury. *See also* COURT.

**Chandelier** in its original form a pendent candle holder but now often adapted for use with gas or electric light. An early form was a wooden ring but later iron brass or even silver was used very often in the ring shape. A later form was that of a centre piece with radiating ornamental arms. In the 18th cent glass came into use and chandeliers more ornate with pendants in the form of tubes drops and balls. Towards the end of the 19th cent in keeping with the very low artistic standard in interior decoration chandeliers degenerated into complicated arabesques of brass with large opaque glass globes. With the rise of electric lighting the mediæval ring form fitted with imitation candles became fashionable for a time but now the

introduction of diffused lighting has done away with elaborate centre lights.

**Chandernagore**, French town in India on the Hugli 18 m from Calcutta. It became a French possession in the late 17th cent and rose to considerable commercial importance. It was taken by the English in 1757 and again during the Napoleonic wars but finally returned to France in 1816. It has declined considerably in importance in recent years. Pop. 6000.

**Chandos, Barons and Dukes of**, title of English family of Brydges first borne by John Brydges 1st Baron Chandos (1554) the dukedom being given to James Brydges 1719 for service in the War of the Spanish Succession. Anna Elizabeth daughter of James Brydges grandson married Richard Grenville 1796 who was created Duke of Buckingham and Chandos 182.

**Chandragupta Maurya** (*fl* 300 B.C.) Indian ruler and founder of the Maurya dynasty called by the Greeks Sandrocottus. After the death of Alexander the Great he attacked the Greek garrisons in India conquered the kingdom of Magadha of which he had been dispossessed and extended his sway over the whole of India. He died c. 260 B.C. *Indica* a work by Megasthenes Seleucus ambassador contains good accounts of the court and government of Chandragupta.

**Chang-chow** Chinese city in the Fukien province 35 m W of the port of Amoy. The city is especially noted for its silk manufactures. Pop. 50000.

**Chang-sha**, city of S China in the Hunan province. It is a treaty port and has a large trade in antimony coal and rice. Pop. 636000.

**Chang Tso-lin** (1873-1939) Chinese general a Manchurian brigand leader 1904 Chinese army commander and Governor of Fengtien 1913 Inspector General of Manchuria 1918 attempted several times to stabilise the central Peking Chinese Government. After the S army's advance on Peking in 1918 Chang fled to Manchuria but was killed by a bomb on the way.

**Channel, English**, a great strait, narrower to 19½ m at the Strait of Dover, between the S and SE coasts of England and the NW coast of France, connecting the Atlantic Ocean with the North Sea. It was of great importance in past English history as a natural barrier against invasion, but with the progress of aerial warfare its defensive value has declined. See also CHANNEL TUNNEL.

**Channel Ferry.** During the World War cross-Channel barges able to navigate French and Belgian canals were dispatched from Richborough in Kent, returning with salvage, etc. This considerably lightened the traffic on French railways and at French ports. More than 350 tugs and barges were used in this work, and upwards of 20,000 journeys were safely undertaken. The service was later augmented by a train ferry between Richborough and Calais.

**Channel Islands**, a group of islands, a British possession, in the English Channel W of the French department



Le Creux Harbour, Sark

of Manche. The main islands are Jersey, Guernsey, Alderney, Sark, and Herm, the others being little more than rocky islets. There are many dangerous reefs in the immediate neighbourhood, and the tidal race is considerable. The islands enjoy a mild climate, and specialise in intensive agriculture for the English markets: new potatoes, tomatoes, and early fruit and vegetables of all kinds produce a large annual revenue, and special breeds of

cattle notable for their milk are raised. Fishing is an important industry, and there is some granite quarrying. Tourists are a considerable source of revenue in the summer months; taxation is light, and there is general prosperity. Area, 70 sq m, pop. c. 97,250.

Jersey, and Guernsey and its dependent islands, are each administered by a Lieutenant-Governor, and an elected assembly, the States, presided over by a Bailiff.

The islands have been British since 1066. During the French Revolution many Royalists settled there, including Chateaubriand, and privateering brought considerable wealth. Victor Hugo lived in Guernsey for many years from 1852.

**Channel Tunnel.** A project to connect France and England by subterranean road and rail was first suggested to Napoleon III, its possibilities being thoroughly explored in the mid-19th cent. A scheme was approved by engineers, and in 1872 an English Channel Tunnel Company began operations. Progress was, however, held up by Parliament at the instance of the military authorities, who regarded it as prejudicial to the safety of the country. The defensive factor has ever since remained decisive, and in 1930 the project was again defeated in Parliament. The estimated cost of a tunnel 30 m long is £30 millions.

**Chansons de Geste**, French medieval epic poems dealing with feats of chivalry and arms, written mostly in 10 syllable lines, arbitrarily divided into stanzas (*laisses*) and linked, not by rhyme, but by assonance. Earliest and best is the *Chanson de Roland*, and most of them, especially the earlier, deal with the acts of Charlemagne.

**Chantilly**, town, N France, department of Oise, 25 m N of Paris. It is a holiday centre for the capital, and horse-races are held there. Chantilly was at one time famed for its lace. Its magnificent château is a notable example of the Renaissance architecture. Pop 58,000.

**Chantrey**, Sir Francis Leggatt (1781-

181 ) English sculptor and the founder of the Chantry Bequest. His works include the statues of George IV in Trafalgar Square, of Pitt in Hanover Sq of James Watt in Westminster Abbey and the group of two sleeping children in Lichfield Cathedral.

At his death Chantrey left the great part of his fortune to form a fund for the purchase of British paintings and sculpture. The administration of the Chantrey bequest is vested in the Royal Academy; the works purchased were housed for a time in the Victoria and Albert Museum at South Kensington but were later transferred to the Tate Gallery where the whole of the purchases now amounting to over 700 works can be seen. In 1904 a dispute arose as to the administration of the bequest by the Royal Academy following on much criticism of their selection and a committee appointed by the House of Lords to investigate the charges made certain recommendations but absolved the Academy from blame.

**Chant Royal**, a fixed poetical form of French origin consisting of five 11 line stanzas followed by an envoy of 5 6 or 7 lines very much like a more elaborate ballade (q.v.). The last line of each stanza and of the envoy is the same constituting the refrain.

**Chantry** a chapel set apart for celebration of Mass for the benefit of the soul of some particular person deceased or for some other pious purpose.

**Chapbook**, the name given to a class of tracts or pamphlets which appeared early in the 15th cent. They were hawked about by chapmen or pedlars and were at one time the only form of popular literature. They dealt with a wide variety of subjects such as history religion the weather dreams and ghost stories.

**Chapel** a building smaller than a church used for Christian worship or a portion of a church with a separate altar set apart for some particular devotion. The name is also given to a place of worship erected by Noncon-

formist sects as opposed to those of the Church of England.

**Chapel Royal**, a college of Anglican ecclesiastics comprising a dean sub-dean 10 chaplains in ordinary and 48 other clergy who officiate in the Chapel at St James's Palace and are chaplains to the King. The name is also given to the royal chapels at Windsor and Holyrood.

**Chaplin, Charles Spencer** (b. 1889) celebrated film actor. He was born in London and went on the variety stage at an early age. He later joined Fred Karno's company which took him to America where he was noticed by Mack Sennett and took up a contract with the Keystone Company. He formed the Chaplin Film Company in 1918 and produced many outstanding successes including *Shoulder Arms*, *The Kid*, *The Gold Rush*, *The Circus* and *City Lights* his talkies in 1931.



Charles Chaplin

**Chaplin, Henry 1st Viscount** (1840-1931) English statesman. Conservative M.P. 1868-1916 when he was made a peer. Chancellor of the Duchy of Lancaster 1885-6. President of the Board of Agriculture 1890-92. President of the Local Government Board 1890-1900.

**Chapman, George** (c. 1559-1634) English poet and dramatist. He wrote for the Swan Theatre in 1598 for plays he wrote for the Swan Theatre including *Easter* and *How* in collaboration with Ben Jonson and John Marston. His famous translation of *The Works of Homer* *Prince of Poets* (1616) though his tastes and style are clearly concerned with those of the

classical translator, Chapman's work was greatly popular for centuries. Its fiery style and romantic language made a deep impression on John Keats, who paid homage to Chapman in his famous sonnet, *On first looking into Chapman's Homer*.

**Chapter: 1 (Cathedral)** An ecclesiastical body composed of the Prebendaries and canons of a cathedral under the presidency of a dean, in England it governs the cathedral and formally elects the bishop after having received Royal permission. Roman Catholic cathedrals are governed by Canons and a Provost.

**2 (Conventual)** The daily meeting of the inhabitants of a religious house at which a chapter of the rule is read, and the general affairs of the monastery are discussed.

**Char**, name for a group of freshwater fishes of the N hemisphere, related to salmon and trout. Some species are similar to salmon in habits, ascending rivers from the sea to breed. Others are confined to land-locked lakes, and by isolation have become differentiated into distinct local kinds.

**Charabanc** [*pron* SHAR'ÜBANG], originally a 4-wheeled horse vehicle with cross benches for passengers. The name was applied to large open passenger motor-cars built on the same plan, holding from 12 to 30 passengers, and used principally for picnics and excursions. On regular services the motor-charabanc has developed into the improved form of motor-coach (*qv*).

**Charade** [*pron* SHARAHD'], a game or puzzle in which a word of 2 or more syllables has to be guessed from clues given for each syllable and for the whole word. As a puzzle the clues are written, often in verse, as a party-game sides are usually formed, each of which in turn acts the clues to a chosen word for the other side to guess.

**Charcoal** is carbon that has been prepared by the ignition of organic material, such as wood or bone, in a limited quantity of air (see CARBON, BONE PRODUCTS).

**Charcot, Jean Martin** (1825-1893), French neurologist, his celebrated work at the Paris Salpêtrière resulted in its becoming the most important neurological clinic of modern times. Charcot taught that hysteria is of psychopathic origin, and that it can be much influenced during hypnosis. Freud (*qv*) studied under Charcot, and developed the psychoanalytical method of treatment of neurosis.

**Chardin** [*pron* SHAR'DAN], Jean Siméon (1699-1779), French painter, born in Paris, where he studied under Cazes and Coypel. He painted still-life pictures of simple homely objects, flowers, and scenes of a domestic character. Examples of his work hang in the Louvre, and there are four in the National Gallery.

**Chardonnet process**, see CELLULOSE.

**Charente**, department of W France, adjoining, and immediately E of, Charente-Inférieure. Except for a rocky region in the N E, the surface is flat, and the soil productive. Cereals, fruit, and potatoes are largely cultivated, there is a considerable wine industry, and cognac brandy is a local product. Charente is watered by the river of that name and by the Tardouze, Né, and other rivers. Flour-milling, leather, paper, and earthenware are the leading industries. Towns of note are Angoulême, the capital, Jarnac, Cognac, and Barbezieux. Area, 2300 sq m, pop 313,000.

**Charente Inférieure**, French department on the W coast between Vendée (N) and the mouth of the R Gironde (S), and including the islands of Ré and Oléron. The soil is productive, and there are several rivers, of which Charente and Gironde are the chief. Crops consist mainly of cereals, potatoes, and grapes. Dairy farming, and horse and cattle rearing are important, other industries are metal founding, ship-building, and glass-making. The principal ports are La Rochelle, and Rochefort. Area, 2790 sq m, pop 418,000.

**Charenton**, French town in the Seine department 4 m S E of Paris.

Grand Remonstrance and following his invasion of the Commons in 1649 Charles raised his standard at Notting ham. The Royalists held their own until in 1644 Cromwell's Parliament ary army aided by the Scots defeated them at Marston Moor and again at Naseby in 1645. The Scots handed Charles over to Parliament in 1647. In 1649 he was tried and executed as a traitor in Whitehall.

**Charles II, King of Great Britain and Ireland (1630-1685)** son of Charles I retired after the Civil War to France. Supported by the Covenanters he landed in Scotland and was crowned King in 1650 but after his defeat at Worcester (1651) he sought refuge again in France. Recalled to England in 1660 he endeavoured to secure religious toleration for Roman Catholics but set on foot intolerant measures against the Nonconformists while the Covenanters were persecuted in Scotland. The disasters of the Dutch Wars (1665-7) led him to dismiss Clarendon and the succeeding Cabal Ministry by the Treaty of Dover gave France control of English foreign policy. The Popish Plot increased the power of the Protestant exclusionists who wished to bar Charles's brother James from the throne but Charles gradually won back the support of the nation particularly on the discovery of the Rye House Plot. From then (1683) on Charles worked for the restoration of Catholicism. His reign was marked by the further transfer of power to Parliament by progress in the administration of the Treasury the Navy and the Colonies and by a gradual growth in social toleration.

Charles name of several Kings of France

**CHARLES I** see CHARLEMAGNE

**CHARLES II** see CHARLES II Emperor

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**CHARLES V** the Wise (1337-1380) ruled France during the imprisonment of his father John II in England after John's defeat at Poitiers in 1356. Charles had to face the hostility of the States General the merchants and the peasants who rose against him in 1358. Crowned king on John's death in 1364 he subdued Charles of Navarre restored order internally and renewed war with England. By 1380 he had regained almost the whole of his kingdom.

**CHARLES VI** (1369-80-14 ) son of Charles V was the first Dauphin. Revolts in N France occurred during the regency of his uncle. In 1383 Charles prepared to invade England but his misrule due to his growing insanity led to internal disorder. Henry V of England in aiding France defeated Charles at Agincourt in 1415 and gained virtual control of the kingdom by the Treaty of Troyes 14 0.

**CHARLES VII** (1403- 61) son of Charles VI exercised an insecure hold over his kingdom until Joan of Arc led his forces to triumph against the English invaders. After her death in 1431 Burgundy came to his assistance and by 1455 the English retained Calais only. Aided by his counsellors Charles then restored order and prosperity in France.

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**CHARLES IX** (1 0-40- 4) was son of Henry II and Catherine de Medicis. Dominated by his mother he sanctioned the massacre of Protestants on St Bartholomew's Day. He died 2 years later.

**CHARLES X** (175 -18 6) younger brother of Louis XVI succeeded his brother Louis XVIII in 1834. His incompetence led to his abdication in 1830.

**Charles, Kings of Naples and Sicily**



sums administered by them exceed £70 millions

**Charity Organisation Society** (*see also* SOCIAL SERVICE), was organised in 1869 to put charitable efforts on a business basis. The theory of this and similar organisations in other countries is that investigation should precede relief, and that begging and private alms-giving should be abolished. Owing to the system of social insurance in England there is not so much scope for their work and methods as in the U.S.A., where all relief for the unemployed is left in private hands.

**Charivari** [*pron* SHARIVAH'RI], rough, harsh music. It is the title of a French humorous paper started in 1832 by Philpon, and was taken by *Punch* (*qv*) as a second title (*the London Charivari*).

**Charkhari**, state and town in the Central India Agency in Bundelkhand. Agriculture is carried on, and the main products are cotton and grain. The town, which lies some 45 m. W. of Banda, trades in these commodities. Area, 790 sq. m., pop. State 124,000, town 10,000.

**Charlemagne** (*Charles the Great*), (c. 742-814), King of the Franks and

Emperor of the West, sole king from 771. Conquered the Lombards, 774, taking the title of King, and exacting tribute from ruling dukes; he maintained friendly relations with the Pope. Charlemagne subdued the Saxons in intermittent

787, obtained the protectorship over territory in N. Spain; was crowned Emperor by Pope Leo III in 800. After a minor naval battle against the Greek empire, the E. and W. divisions of the Empire were recognised as equal (810). Charlemagne fought later wars with the Danes. After nominating his son Louis as his successor, he died 814.

His reign was marked by a revival in art and literature, and by the foundation of monastic schools to which were due the preservation of classic masterpieces. Charlemagne was the patron of such scholars as Alcuin and Einhard, advanced learning among the clergy generally, and revised the laws of his Empire. His descendants, the Carolingians, formed the second dynasty of French kings.

**Charleroi**, town in S. Belgium on the R. Sambre. It is in the principal coal-mining area, and has important metal, engineering, and glass industries. It was fortified at the instance of the Duke of Wellington in 1816, and was the scene of a battle early in the World War (*qv*). Pop. 28,000.

**Charles I**, King of Great Britain and Ireland (1600-1619), second son of James I, succeeded to the throne in 1625. He married Henrietta Maria of France. His insistence on the divine right of kings brought him into conflict with Parliament, which attacked his favourite, Buckingham, and forced him to sign the Petition of Right in 1628 before granting him supplies. Charles dissolved Parliament in 1629, and till 1640 asserted absolute rule. His endeavours to raise funds by means of ship-money, and his intolerance towards the Calvinists (instigated by Archbishop Laud) intensified hostility in Scotland as well as in England. Charles summoned the Short Parliament in 1640, dissolved it, and convened the Long Parliament, which forced him to consent to various reforms, and to the execution of his adviser, Strafford, by the Bill of Attainder in 1641. Parliament sought control of the Government by the



Charlemagne

warfare, 772-99, Christianised them, and regulated their laws; annexed Bavaria,

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**Charles, Kings of Naples and Sicily**

**CHARLES I** (c 1220-65-85), King of Naples and Sicily, extended his dominion from Anjou to Tuscany, Lombardy, and Piedmont. But his cruelty led to a revolt ("the Sicilian Vespers") and he was defeated by Rugiero, 1282 and 1284. His son, **CHARLES II** (c 1248-85-1309), was forced to cede Sicily to the Aragonese, 1288, but was later proclaimed ruler of the island by the Pope. Frederick of Aragon contested his claims, and Charles surrendered Sicily to him in 1302.

#### Charles, Kings of Spain.

**CHARLES II** (1661-5-1700), son of Philip IV and last of the Spanish Habsburgs. Feeble from birth, he died childless. His bequeathing of Spain to Philip, Duke of Anjou, gave rise to the War of the Spanish Succession.

**CHARLES III** (1716-59-88), son of Philip V, conquered Naples and Sicily, 1734, but his hostility to England led him into a disastrous alliance with France in the Seven Years' War.

#### Charles, Kings of Sweden

**CHARLES XII** (1682-1715), King of Sweden, son of Charles XI, defeated the Danes, 1700, then the Russians at Narva, and deposed Gustavus, King of Poland. Invading Russia, he was routed by Peter the Great at Poltava (1709), and fled to Turkey. Exiled in 1714, Charles returned to Sweden, and was killed during an invasion of Norway.

**CHARLES XIV** (1763-1844), King of Sweden, known as Jean Baptiste Bernadotte, rose during the French Revolution to command the French army in La Vendée. Napoleon created him a marshal in 1804. He governed Hanover, 1804-5, but fell into Napoleon's disfavour during the campaign against Austria. Adopted by Charles XIII (1810) as heir to the Swedish throne, he brought about the union with Norway, and as King restored order and prosperity to both countries.

**Charles I** (1887-1922), last Emperor of Austria and King of Hungary, was the son of the Archduke Otto and Princess Maria Josepha of Saxony. He married (1911) Princess Zita of Bourbon-Parma. In the World War

he commanded a corps in the 1911 offensive against Italy. On Nov 21 1916, he succeeded to the throne. He made various unacceptable concessions to the Slavs and Magyars, and was forced to quit the country in Nov 1918. Retiring to Switzerland, he made an abortive attempt to regain the throne in 1921. He died in exile in Madeira.

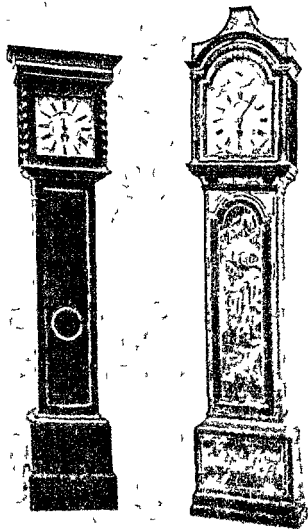
**Charles II** (823-877), grandson of Charlemagne, King of W Franks and Roman Emperor.

**Charles III** (*Charles the Fat*) (832-888), Roman Emperor, King of the W Franks, son of Louis the German. He led fruitless expeditions into Italy, failed to put down the Norsemen in France, deposed 887.

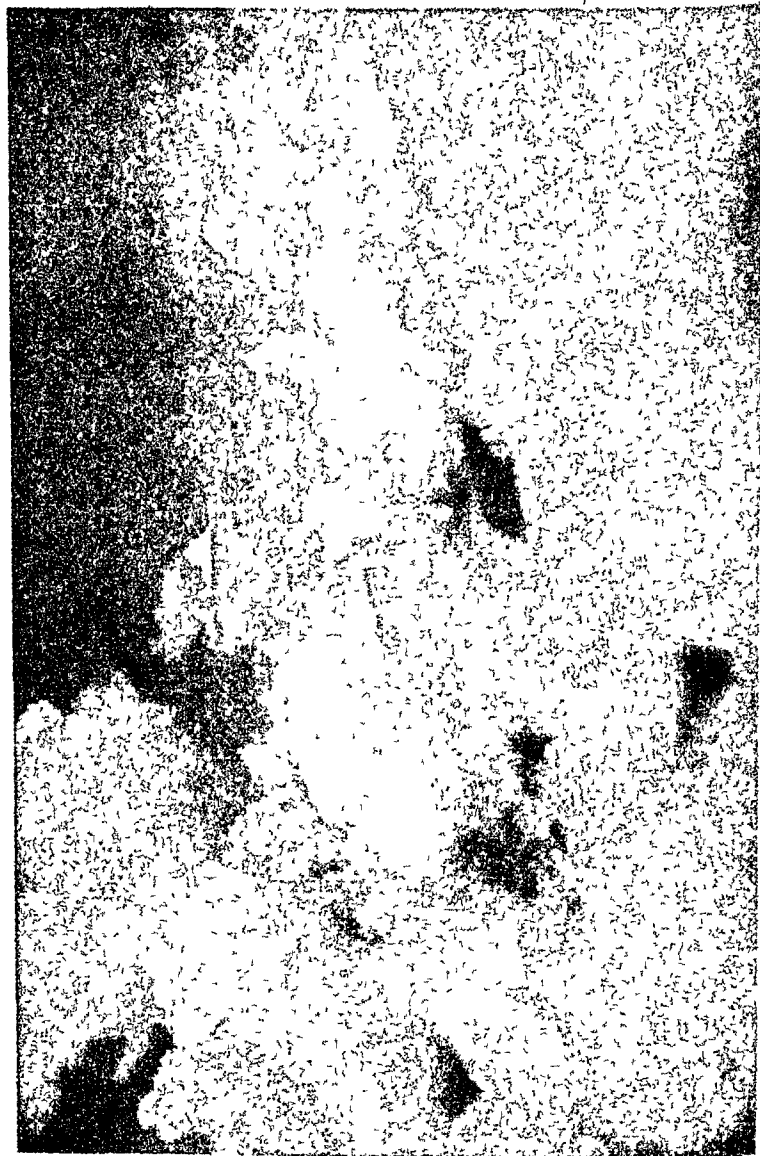
**Charles IV** (1316-1378), Roman Emperor, King of Bohemia, fought at Crécy, 1346, crowned Emperor, 1355, occupied himself mainly with administrative reforms.

**Charles V** (1500-1558), Roman Emperor and King of Spain (Charles I), son of Philip of Burgundy and Joanna the daughter of Ferdinand and Isabella of Castile. Charles succeeded to the thrones of France, Comte and the Netherlands, 1506, to the crown of Spain, 1516, to the Habsburg dominions, 1519, on the death of Maximilian. His wide possessions and the rivalry of Francis I of France meant almost continual military operations. Charles was ruler in the Netherlands, Burgundy, parts of Italy, Spain, and her American posts, the Habsburg Empire and Württemberg. He had to face the problems of Francis, Lutheranism and Turkish incursions into Europe. Crowned Roman Emperor, 1530. He was at war with Francis again, 1535, after 6 years' peace, with Henry VIII he forced the Treaty of Crépy 1544 on Francis and his Turkish allies, came to terms with the German Protestants at Augsburg, 1555, but, disappointed at his inability to enforce Roman Catholicism, abdicated in favour of his son, Philip, resigned the Empire, 1558, and died in Estremadura in the same year.

**Charles Edward Stuart** (1720-1788), the Young Pretender, son of James,



ENGLISH CLOCK  
(18th and 19th c.)



CLOUDS

the Old Pretender Born in Rome Aided by the French he attempted to invade England 1744 He was driven back by storms but eventually landed in Scotland 1745 Supported by Highland chieftains he entered



The Young Pretender

Edinburgh (Sept 17) defeated Cope at Prestonpans captured Carlisle and reached Derby (Dec 4) forced to retreat. N. he defeated Hawley at Falkirk, but was routed by the Duke of Cumberland at Culloden (April 16 1746). In Sept he escaped to France but was exiled under the Treaty of Aix-la-Chapelle 1748. Charles spent the following 10 years in fruitless intrigue and was repudiated in Rome. He married Louise of Stolberg 1770 but they were separated 1778. Died in Rome. His daughter Charlotte died childless.

**Charles Martel** (c 688-741) (*The Hammer*) Frankish ruler grandfather of Charlemagne. Son of Pepin II and Mayor of the Palace under the later Merovingians. He extended his dominion over Austrasia and Neustria 720 and gained fame by overwhelming the invading Saracens at Tours 732. For this he has been regarded as the saviour of Christendom.

**Charles the Bold** (1433-1477) Duke of Burgundy son of Philip the Good. Opposed Louis XI and defeated him at Montlhéry in 1465 but as Louis subsequently seized territory which he had ceded to Charles. Charles invaded France as far as Rouen. He quarrelled with the Swiss, Lorraine and Austria and was defeated and killed at Nancy 1477.

**Charleston** (1) American port S Carolina. The town is one of the most

notable trading centres of the S and its large exports include rice, cotton, phosphates, petroleum products, tobacco and coal. Its harbour works and docks handle considerable naval and commercial traffic and it is the chief import centre for the State. Charleston is a very fine city with numerous public buildings, parks and open spaces. It was besieged during the Civil War by the Federals from April 1863 to Feb 1865 and was devastated by an earthquake in 1886. Pop 63 000.

(2) Capital of W Virginia, USA on the Kanawha R. and in the coal producing district of the State it is an important industrial centre. Manufactures include iron and steel, chemicals, glass and furniture and there is a Government arsenal and munition works. Coal, oil and salt are shipped down the river and there are large quantities of natural gas in the locality. Pop 60 500.

**Charlestown**, part of Boston, Mass. USA originally a separate town is memorable as the scene of the battle of Bunker's Hill in the War of Independence now commemorated by a monument. The cemetery was the burial place of John Harvard.

**Charleville** French town of the Ardennes in the N. lying on the R. Meuse and joined to Mézières by a bridge over the river. Bricks and iron goods are manufactured. There are the ruins of a fortress near by. Pop 9 600.

**Charlock**, see **MUSTARD**.  
**Charlottetown**, capital of Prince Edward Island, Canada. It is situated on Hillsborough R. and has a good harbour. Pop 11 000.

**Charm**, an emblem worn or displayed in a household as a symbol of good luck distinct from the amulet (qv) inasmuch as it implies a positive expectation of good luck rather than a protection against bad. The horseshoe is regarded as a luck bringer and is still seen fastened to doorways and reproduced in miniature on pins and in brooches. There is a

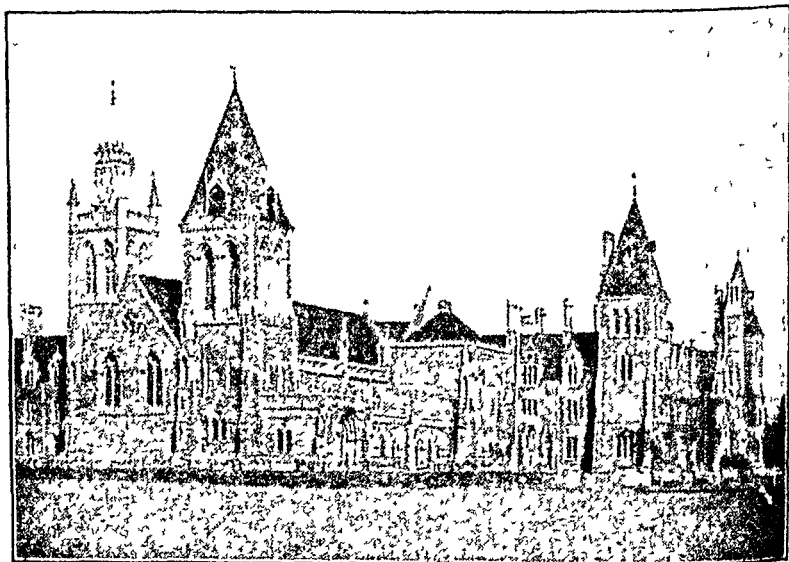
legendary connection between the horseshoe and the crescent, the custom being supposed to have originated at the time of the Crusades. The bell has been regarded by some people as a mascot, and various precious stones have been endowed with superstitious significance. Stones and pieces of wood shaped into miniature representation of such prosaic things as pigs and beans obstinately retain reputations for good fortune.

**Chars**, *see* CARBON, TECHNICAL FORMS *or*.

**Charter**, any formal writing evidencing an agreement between persons. In public affairs, a deed whereby the sovereign guarantees the rights of the subject or confers privileges and powers on certain persons or associations, *e.g.* the charter of a company, of a borough, etc.

**Chartered Accountant**, *see* ACCOUNTANT

**Chartered Company**, *see* COMPANY



Charterhouse School, Godalming

**Charnwood Forest**, a barren upland region in the N of Leicestershire. It is considerably less forested than in earlier centuries, but still has considerable tracts of woodland. Bardon Hill (900 ft) is the highest point.

**Charon** [KĀ'RON], child of Erebus and Night, was the legendary ferryman of the lower world. For a small coin he ferried the souls of the dead across the Styx to the shores of Hades. Hence a small coin (*obolus*) was always buried with a corpse in classical Greece and Rome.

**Charterhouse**, a monastery of Carthusian (*qv*) monks. Their London foundation was established in the 14th cent near Aldersgate, and the monks were dispossessed in the 16th cent. The buildings were endowed in the early 17th cent by a wealthy merchant, Thomas Sutton, as a hospital for aged gentlemen and as a school. The latter, which has grown into one of England's most famous public schools, has been removed to Godalming, Surrey, but the original building is still occupied by the pensioners.

**Charter of Liberties** the Coronation Charter of Henry I in 1100. It promised freedom to the Church to do away with evil customs concerning fines coinage disposal of property by will etc. and to restore the laws of Edward the Confessor as modified by William I.

**Charter party** contract by which a shipowner places his ship at the disposal of another person called the charterer for the carriage of goods.

**Chartier Alain** (c. 1330–c. 1433) French poet who attacked the Court and clergy of France championing the oppressed peasants. Such were the subjects of his *Quadrilogue insectif* (1400) and *Livre d'espérance* (1409). A shorter poem *La Belle Dame sans Merci* was translated into English in 1840.

**Chartism**, a movement for political reform active between 1838 and 1849 working for universal male suffrage secret ballot abolition of a property qualification for Parliament payment of members annual Parliaments and equal representation the points of a proposed People's Charter. The failure of the early trade union movement drove labour agitation from the industrial to the political field and political influence became steadily stronger in Chartism which culminated in a markedly Social st policy in the revolutionary year 1848. Gradual reforms caused a decline of Chartism after that date. See also TRADE UNIONS SOCIALISM FRENCHISE.

**Chartres** [pron SHARTREZ] historic French city 54 m W S W of Paris lying on the R. Eure the capital of Department Eure-et-Loire. Chartres lies in a rich agricultural district and has a famous corn market. Industries include flour milling leather goods timber cutting and sawing brewing and the making of brandy. The town is especially famous for its magnificent 13th-cent Gothic cathedral there are several other ancient churches and some remains of the old fortifications. The city existed in Roman times was

held by the British for part of the 15th cent and occupied by the Germans in 1870. Pop. 23 600.

**Chartreuse Grande** [pron SHARTREZ GRAHND] the first Carthusian monastery founded by St Bruno c. 1084 and the seat of the Order. It is situated in the Isère Department of France a few m from Grenoble which town now possesses most of the ancient library since the monks were expelled by the Government in 1003.

The monks gained additional fame by their invention and manufacture of the liqueur of that name. See LIQUEURS.

**Chasing** a process of embossing metal subsequent to its decoration with the graver brought to a notably high state of perfection by the Greeks. In mediæval times armour as well as cups vases etc. were treated in this way and some elaborate work of this kind was done during the Renaissance. Benvenuto Cellini was a famous master of the art.

**Chassepot** [pron SHASPO] a French breech loading rifle used from 1866 in the Prussian War of 1870–1 and replaced in 1874 named after its inventor.

**Chasseurs Alpins** [SHASE ALPAN] French light infantry regiments trained for mountain campaigning in the French Alps. In the autumn winter and spring they use skis and snow shoes and thus cover great distances over mountainous country.

**Chasseurs d'Afrique** [SHASE DAFREE] French cavalry regiment raised in 1831 stationed in Algeria and Morocco. They are mounted on Arab horses of exceptional speed and endurance. In the Battle of Sedan (1870) when charging the Prussian infantry they were practically wiped out by rifle-fire but were later reorganised and are still used for police purposes.

**Chassidim** [Heb. pious] people referred to in the Psalms as saints. They were a body of religious Hebrews in hiding men of varying views later diverging into the two parties of Pharisees and Sadducees.

The term was also applied to the followers of Judas Maccabeus who



refused to bow to the paganism of Antiochus Epiphanes (170 B C)

In later Jewish history the term has been applied to the members of the Chassidic sect, founded by Israel of Miedziboz (born c 1698), and now spread throughout E Europe. While accepting all the tenets of traditional Judaism, the Chassidim put particular stress on joyousness in worship. Drawing a great deal of their mysticism from the *Zohar* and the *Kabbalah* (qv) Chassidism has given rise to a considerable mystical literature, including the sayings and the acts of the Chassidic rabbis.

**Chastelard, Pierre de Bocosel de** (1540-1563), French poet, was a disciple of Ronsard. He fell violently in love with Mary, Queen of Scots, was found hiding in her room, and was hanged.

**Chasuble** [CHAS'UBL], the outermost vestment worn by a priest in Catholic Churches when celebrating Mass. It is a circular or elliptical piece of silk or other material, with a central aperture for the head, sleeveless, and open at the sides. It is used also by High Church clergymen in the Church of England.

**Château** [SHAHTŌ], the French word meaning castle, derived from the Latin *Castellum*. As in England, the homes of the nobles in the Middle Ages were built to serve as fortresses, but the name Château survived, when they became no more than large country residences. Many of the French châteaux are famed for their architectural beauty, and the valley of the Loire, which contains a number of fine examples dating from the 12th and 13th cent, is frequently referred to as the Château district. Langeais, Blois, and Amboise are typical châteaux in this part of France.

**Chateaubriand, François René, Viscomte de** (1768-1848), Fr author famed for his anti-revolutionary opinions, his mysticism, and his poetical prose-style. He travelled in N America, 1789-92, and lived in England from 1794 to 1799, where he wrote *Les Natchez*, a poetical

study in prose of Red Indian life (pub 1827). One episode of this, *Atala* (1801), has become very famous. His next work, the *Génie du christianisme* (1802) had a deep influence on French literature. René displays the influence of Byron. Chateaubriand opposed Napoleon, and his pamphlet supporting the Bourbons contributed greatly towards the restoration of Louis XVIII. His last great work, the *Mémoires d'outre-tombe*, was published after his death (1849-50).

**Châtelaïne** [SHAT-Ū-LÂN], in mediæval times the consort of a chatelain or keeper of a castle. Term applied to the chains hanging from the belt of a housekeeper, to which such articles as keys, scissors, pencil, knife, etc, were attached.

**Chatham, William Pitt, 1st Earl of** (1708-1778), British statesman, MP for Old Sarum, 1735. His oratory contributed to Walpole's downfall in 1742. He was appointed Vice-Treasurer for Ireland and Paymaster-General in 1746, distinguishing himself by his integrity and disinterestedness. He was dismissed in 1761 for criticising his leader, Newcastle, but was reinstated as Secretary of State in 1756. Again dismissed in 1757 for opposing George II's continental policy, he was immediately recalled to share a ministry with Newcastle.

During his brilliant foreign administration of 1757-61, Chatham revealed himself as England's first great Imperialist. He inspired Wolfe's success in Canada, supported Clive's campaign in India, and aided Frederick the Great in the Seven Years' War against France. Opposing the inclusion of Bute, George III's favourite, in the ministry of 1761, Pitt resigned. In 1765 he advocated the repeal of the American Stamp Act, supporting the colonists on principle. He was called on to form a ministry in 1766, was created Earl, and entered the House of Lords as Lord Privy Seal. Incapacitated by illness, he failed to check his colleague's mistaken measures against the American colonies, and resigned in

168 He re-entered the House of Lords in 1770 and during a debate on America in April 1778 he collapsed. A few weeks later Less successful in domestic affairs than in foreign policy Chatham was nevertheless the first English statesman to enjoy the confidence of the nation at large and deservedly won for himself the name of the Great Commoner

Chatham, English naval station at the mouth of the Medway in Kent adjoining Rochester and Gillingham It has been an important naval dock yard from the time of Elizabeth and in the later years of the 19th century was greatly improved and extended The area of the dockyard is over 500 acres with a river frontage of upwards of 3 miles There is a busy retail trade and industries other than shipbuilding include brick making flour milling and timber Buildings of note are the barracks naval hospital and arsenal Chatham existed before Domesday times at first as a suburb of Rochester until its naval importance was established Pop (1931) 4 996

Chatham Islands, group of small islands in the S Pacific part of New Zealand from which they lie about 500 m due E Only three are of any size the largest being Chatham Much of the soil is fertile and vegetation is rich Cattle and sheep-rearing are carried on wool being the only notable export The islands were discovered by an English naval officer towards the end of the 18th cent the natives are akin to the Maoris and still form about half the pop which numbers 600 (1946)

Chat Moss, a large peat producing area in Lancashire between Liverpool and Manchester Most of it has by now been successfully drained and is given over to agriculture Stephenson succeeded in building a railway across it in the early 19th cent in the face of great natural difficulties

Chatsworth, near Bakewell Derbyshire noted for the neighbourhood of Chatsworth House the celebrated seat

of the Duke of Devonshire This contains a famous picture gallery and the gardens and park are among the finest in England The present house begun in the 17th cent occupies the site of an older one which was for a time the residence of Mary Queen of Scots during her captivity

Chattanooga, industrial town in SE Tennessee USA on the Tennessee During the Civil War Chattanooga was the scene of several engagements notably that of Nov 4-27 1863 when the Confederate army of the W was defeated by the Federals under General Grant Pop (1930) 10 000

Chattel Mortgage a mortgage of goods analogous to a mortgage of land and usually made by a conditional bill of sale allowing the mortgagee to redeem the goods at a specified time If the goods are not transferred to the lender then the mortgage must be by deed registered in accordance with the Bills of Sale Act 188 See also BILL OF SALE

Chattels, goods movable and immovable except such as are in the nature of freehold property They are either *personal* e.g. furniture cars household property or *real* e.g. land held for a term of years See also PROPERTY

Chatterers, a family of birds restricted to S America of which the best known kinds are the cock of the rock (qv) the bell bird (qv) and the umbrella bird (qv)

Chatterton, Thomas (1752-170) English poet wrote many poems in quasi-medieval style which he passed off as the work of one Thomas Rowley a British priest who had lived in the reign of Henry VI These Rowley MSS gained great fame and many distinguished scholars accepted their genuineness The best known of these poems is *Elfrida* a dramatic fragment of great beauty In 1770 Chatterton came to London where his genius gained him some fame but unfortunately little money After 4 months he committed suicide in his garret

when only 18 years old Wordsworth, Coleridge, Keats, and Rossetti have all paid tribute to his greatness

**Chaucer, Geoffrey** (1340?-1400), English poet, was the son of a vintner. He became a page in the service of the Duke of Clarence, and later took part in the war in France. In 1367, he married the sister of Katherine Roet, later the wife of John of Gaunt. His first known poem, *The Book of the Duchess*, commemorates the death of John of Gaunt's first wife (1369). He now held important diplomatic and political positions, and became rich and prosperous. In 1374 he moved to Aldgate, where he remained until 1386. His fortunes fluctuated during



Geoffrey Chaucer

the reigns of Richard II and Henry IV, but he seems to have died in comfortable circumstances. His early works are either translations from the French or are clearly marked by French influence. They include the *Romaunt of the Rose* (a translation of *Le Roman de la rose*), the *Book of the Duchess*, and the *Complaint to Pity*. The poems of his middle period show Italian influence, the styles of Dante, Boccaccio, and Petrarch can be traced in many of his *Canterbury Tales*, in *The House of Fame*, *The Parlement of Foules*, and in *Troilus and Criseyde*. His translation of Boethius's *De Consolatione Philosophiae* is also included in this period. Of his other works, *The Legend of Good Women* may also be mentioned.

*The Canterbury Tales*, his most popular work, consists of a collection of some twenty-four stories told by a party of pilgrims on their journey to the shrine of Becket at Canterbury.

Chaucer's powers of characterisation and humour and his perfect realisation of the atmosphere of mediæval England inform the whole with a charm and colour that have never been equalled.

Greater as a complete poem, but not so popular, is his *Troilus and Criseyde*, an adaptation of Boccaccio's *Filostrato*. The poem, which is written in seven-line stanzas, is a perfect example of his art, his treatment of character, his sense of the tragedy of youthful love, and his colourful descriptions here equal anything that he ever wrote.

**Chaudfroid**, a cold entrée consisting of daintily cut pieces of meat or fish, covered with *chaudfroid sauce*, brown or white.

#### White Sauce

$\frac{1}{2}$  pint Béchamel or Velouté sauce (see SAUCES)

2-3 tablespoonfuls liquid aspic; or  $\frac{1}{4}$ - $\frac{1}{2}$  pint jelly (2 $\frac{1}{2}$  oz. gelatine to 1 quart stock)

#### Brown Sauce

$\frac{1}{2}$  pint espagnole or other brown sauce  
2-3 tablespoonfuls liquid aspic

$\frac{1}{4}$  or meat glaze

The sauce-covered ingredient may be decorated with chervil, tarragon, tomato skin, ham, truffle, tongue, radish skin, etc., and a little aspic poured over each piece.

**Chaulmoogra Oil**, a fatty oil obtained from the seeds of *Taxodium kurzii*, King, a tree growing in Burma. The oil and preparations made from it are used with success in the cure of leprosy, but have been to a large extent replaced by similar products from *Hydnocarpus wightiana*, Blume, yielding hydnocarpus oil (qv). See also OILS, FATS, AND WAXES.

**Chauvinism** [*pron* shōVINIZM], an exaggerated patriotism and nationalism typified by Nicholas Chauvin, an old French republican soldier devoted to Napoleon (cf. JINGOISM).

**Chavannes, Puvion de** [*pron* PUVÉ DŶ SHAVANN], Pierre Coole (1824-1898), French painter, was born in Lyons, and studied in Paris. Dissatisfied with the art schools, he set up an academy of his own in 1852 in the Place Pigalle.

His work was rejected by the Salon for many years and it was not until he began to exhibit his large decorative paintings that he obtained any general recognition. He painted a number of panels for the decoration of the Amiens Museum and the series illustrating the life of Ste Geneviève which he later painted for the *Lans* Panthéon were among his most successful works. The Sorbonne and the Hôtel de Ville in Paris and the Boston Library also possess fine examples of his paintings. His work shows the influence of the Italian primitives but has little of the archaic. He was a master of decorative design using pale quiet colouring and simplification of drawing with excellent effect. One of his best known easel pictures is his *Pauvres Pêcheurs* a sombre group of fisher folk on the sea-shore.

**Chavasse, Francis James** (1846-1908) English divine and Bishop of Liverpool 1900-03. He was largely responsible for the building of the new Anglican Cathedral at Liverpool.

**Cheap Money Policy** When money is said to be cheap it does not mean that its value is low in comparison to goods or to some other currency. It merely means that the *hire* of it is cheap. In other words the interest rates at which it can be borrowed are low. When a Government or Central Bank is said to be pursuing a cheap money policy it is taking such steps as it can to keep money rates—and interest rates chargeable by banks and other lenders low. The reason for a cheap money policy during times when trade is slack is to encourage traders and producers to borrow in order to expand business. The opposite—a dear money policy—is resorted to in order to check excessive expansion in business. Dear money policy was for much of the time also deemed necessary during the post War period to protect the gold reserves in the face of strain in the exchange position of sterling (see GOLD STANDARD).

Money rates are controlled by the supply of and demand for loanable

funds but may be influenced to a considerable extent by the Central Bank through its official BANK RATE (qv). See also BANK OF ENGLAND and BANKING AND CREDIT.

**Cheddar** small Somersetshire town about 15 m S.E. of Weston super Mare. Its limestone gorge and caves attract many visitors. Remains of prehistoric and Roman habitation have been found. The town has given its name to a well known brand of cheese because it is here that its manufacture was first practised. Pop. c. 1000. See CHEESE.

**Cheduba**, British island off the W coast of Burma producing rice tobacco and petroleum. Minerals include silver iron and copper but are not yet much worked. The hills show signs of extinct volcanic activity. The natives are mainly Maghs. Cheduba was Burmese territory from the 18th cent. until it fell to the British early in the 19th. Area 230 sq m. pop. c. 9,000.

**Cheese** one of the main protein foods containing usually 2 per cent of first-class protein chiefly in the form of casein. The quantity of fat containing Vitamin A is usually c. 33 per cent in a full milk cheese. It is one of the best sources of calcium valuable on account of its bone and teeth forming properties. Cheese was one of the earliest foods to be prepared by virtue of its easy manufacture and concentrated nature. The coagulation of milk is brought about naturally by a bacterium or can be artificially induced by acids or by rennet, a soluble substance of complex chemical nature found in the fourth stomach of the calf. The curd precipitated by one or other of these means contains the casein content of the milk and also a certain amount of fat while the thin watery liquid left contains milk sugar and a little nitrogenous matter.

**Cheese making** The milk is usually brought to a temperature of c. 100°F (varying with the kind of cheese) and rennet added. Milk must be ripened before the rennet will act and this is

often hastened by adding a "starter" of sour milk, which aids in the formation of lactic acid. The whole is beaten while still warm to break the chunks of curd into smaller pieces, and then transferred to cloths, and squeezed in a press to separate the whey. The cheese is then stored where the flavour can develop, and turned daily.

*Use of Rennet.* This substance is extremely active, 1 part being said to coagulate 3 million parts of milk. It is most active at body temperature (98° F), and temperature must be most carefully controlled during the process of cheese-making.

Cheeses are classed as *soft* and *hard*, and there are many varieties in each group. English soft varieties are the cottage and cream cheeses, the hard cheeses belong to the Stilton or the Cheddar type. Of foreign cheeses, Bondon, Brie, and Camembert are soft, and Gruyère, Edam, Gorgonzola, Parmesan, and Roquefort hard.

*Cottage Cheese* is a curd obtained by rennet precipitation, heated to c 100° F, drained through linen, and salted, pressed, and kneaded by hand. It is usually eaten immediately, but if stored the flavour improves.

*Cream Cheese* is made from cream only or from a mixture of cream and milk. It is rich in milk-fat, and is sold uncured.

*Camembert* was first made by Marie Fontaine at Camembert, France, in 1791. The ripe cheese is covered with a reddish-brown mould and the interior is a soft buttery mass. It is made from mixed morning and evening milk.

*Brie* is made in the N W of France, and resembles Camembert in many respects.

*Cheddar Cheese* was made in the village of Cheddar more than 250 years ago. The process of making it is complicated and slow. The curd is precipitated, cut, heated, "cheddared," or cut into rectangular blocks and piled to drain, and then ground and salted and pressed. The cheese is ripened at 65-70° F. for 4-6 weeks.

*Stilton Cheese* is ripened by the aid of the mould *Penicillium glaucum*, the fungus which gives rise to characteristic circular patches of green mould with a white fringe. The cheeses of this type are made in the N of England.

*Gruyère Cheese* has been made for several hundred years in the mountainous regions of Switzerland. It is characterised by the holes or "eyes," due to the gas produced by certain bacteria.

*Gorgonzola* is made chiefly in the N. of Italy, and has a rich pungent flavour. It is white with green streaks where *Penicillium* has penetrated the mass.

*Parmesan*, also an Italian cheese, has excellent keeping properties and is best after ripening for 2 years.

*Pressed Cheese.* One standard size cheese requires 6 gallons of fresh sweet milk. This is strained, heated slowly to 90° F, and rennet is then added in the proportion of 1 dram in 6 times its volume of water, to 3 gallons of milk, and thoroughly stirred for 3-4 minutes, after which the surface of the milk is gently stirred until coagulation begins, when the stirring must immediately cease. The curd is cut, when just brittle, into small cakes, and these are scalded at 106° F and stirred until the curd becomes firm. It is then allowed to separate, and the whey poured off. The curd is salted with 1 oz of salt to 2 gallons of milk, packed in cheese moulds, then pressed under 2 cwt pressure. The cheese requires c 3 weeks to ripen, the finished product weighing c 6 lb.

*Cooking.* Eaten alone, or after a large meal, cheese tends to be indigestible, but can be mixed with carbohydrates in the form of bread, macaroni, or spaghetti. It is cooked when melted. Recipes containing cheese should be cooked at moderate temperatures, as high temperatures and long cooking make it stringy and tough. Parmesan cheese, or Cheddar, which is less expensive, are generally considered the best for grating on account of their hardness.

*Macaroni Cheese to Make*

1 oz macaroni  
1 oz cheese  
1 pint white sauce (flowing)  
1 teaspoonful made mustard  
Pepper and salt

Break macaroni into small pieces and cook c 30-40 minutes in boiling salt water until tender. Make white sauce and add about three-quarters grated cheese. Pour over macaroni in pie-dish. Sprinkle it with remainder of cheese. Brown under hot grill or for a few minutes in a hot oven.

*Welsh Rarebit*

3 oz cheese  
1 1/2 tablespoonful milk or beer  
1/2 teaspoonful mustard (made)  
Salt and pepper  
Toast 1 slice  
Heat grated cheese with seasoning and milk at a gentle heat until melted. Pour over toast which may be buttered. Place under hot grill to brown slightly.

*Cheese Fondue*

3 oz cheese  
2 oz breadcrumbs  
1/2 pint milk  
2 eggs  
Mustard  
Pepper salt  
Pour hot milk on to yolks of eggs and add to grated cheese and bread and stiffly whipped whites of eggs. Bake in a moderate oven (300 F) 15 minutes.

**Cheese-hopper** the larva of a small well known as infesting cheese on which it feeds producing the state known as maggoty. Its name is due to its habit of hopping when disturbed. This it achieves by seizing tail with its mouth suddenly raising its hold and straightening it after the manner of a piece of bent wire.

**Cheese Mite**, a mite with long bristles on its back often found in abundance feeding on cheese especially Stilton which it reduces to the characteristic watery condition.

**Cheetah or Hunting Leopard** a large member of the cat family found in S W Asia and Africa. It is yellowish in colour and typically closely covered with black spots. Its claws are not sheathed as in ordinary cats. It has a small head and long slender legs and does not climb. For a short distance it is said to be the swiftest footed of the Carnivora (q.v.) and on this account has long been tamed in India for coursing blackbuck and gazelles which it can run down over a short distance in the open. A handsome variety known as the King Cheetah with the pattern formed of large blotches and bands has recently been discovered in Rhodesia.

**Chefoo** Chinese port on the N coast of Shantung W of Wei-hai-wei with a considerable export trade. It has a large and well protected harbour and is still a treaty port. Pop (1931) 130,000.

**Chekhov Anton Pavlovich** (1860-1904) Russian playwright and writer of short stories took a medical degree in 1884 but devoted his life to literature. His early stories are humorous but not unusually brilliant but after 1889 he produced a series of masterpieces *Hard No 6* (1897) and *The Lady with the Dog* (1899) are two of his greatest stories. They are psychological in treatment and show a penetrating insight into human moods and sufferings. Their subjects are morbid and pessimistic but intensely interesting. But Chekhov is better known for his serious plays these are *Ivanov* (1897) *The Seagull* (1898) *Uncle Tanya* (1899) *The Three Sisters* (1901) and *The Cherry Orchard* (1904). They show a complete break with tradition. They have no definite heroes and heroines—all the characters are of equal importance and in them Chekhov's realisation of character atmosphere and emotion is at its highest.

**Chekiang** province on the E. coast of China immediately N of Fukién. The surface is hilly and the coast much indented and fringed with islands.

surface often takes the form of a steam-heated roller, upon which the liquid is sprayed and where it dries at once, leaving a solid film which is scraped off by rotating the cylinder past a knife. These methods are largely used in the case of liquids such as milk, which are liable to decompose by continuous heating.

The operation of filtration consists in removing solids from liquids by passing the mixture through a finely porous screen. The standard apparatus for this purpose is the *filter press*. This consists of a steel frame which holds clamped together a large number of frames between which pieces of cloth

the circumference of the drum is covered with filter cloth stretched over perforated metal. The liquid is sucked by the vacuum into the submerged compartment and away, while the solid forms a layer on the drum. As the drum rotates, each compartment in turn rises above the surface of the liquid, whereupon the attached cake is nearly dried by suction. If desired the cake may then move past a spray of the pure liquid, which washes it. Finally it passes over to the other side and is scraped off by a fixed knife.

In place of filtration, and for many purposes of drying, the *centrifuge* (*qv*) is used.

**Chemical Equations, see EQUATIONS, CHEMICAL**

**Chemical Warfare.** Warfare which employs chemical substances as opposed to explosives and projectiles.

The idea of causing discomfort or death to one's opponents by means of noxious fumes is by no means modern; in the Greek and Roman campaigns the burning of substances such as pitch and sulphur was a common practice. The first modern suggestion for gas warfare was made in 1855 by Lord Dundonald, who proposed that sulphur should be burnt in suitable positions in front of the forts of Sebastopol in order to compel their evacuation by the asphyxiation of the defenders. The conservative military staff rejected this ingenious proposal on the grounds of inhumanity.

That the use of poisonous substances in this manner was widely considered appears from the provisions of The Hague Conference of 1899, and of The Hague Congress of 1907, at both of which the use of poisonous gases and substances was denounced, many nations subscribing to a pact against their use.

It is undisputed that the first large-scale use of gas in the World War was made in April 1915 by the Germans, who used chlorine as the toxic substance. It may be contended from an examination of the facts that the proportion of men killed or per-

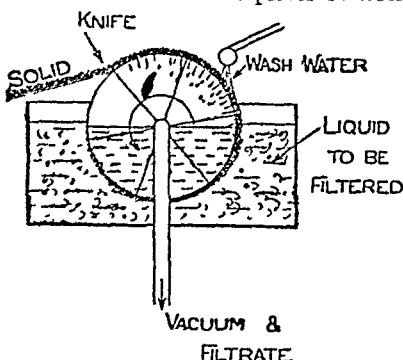


Fig 3 Rotary Filter

are placed. Each frame has two attached lugs, which together form channels, one through which the liquid and solids are pumped in, and the other through which the clear liquid flows away.

This apparatus requires to be taken apart when it is filled with solid matter up to its capacity. In order to avoid this, a great many forms of *rotary filters* have been devised. A commonly used type of this kind is the *Oliver* (Fig 3), it consists of a cylindrical drum divided into a number of compartments and rotating in a trough of the liquid to be filtered. Through the axis of rotation, a vacuum is applied only to those compartments which are under the liquid or rising from it. The cir-

manently disabled by gas casualties was considerably less than that from casualties caused by high explosives and projectiles. In the United States Army the proportion of deaths from gunshot wound casualties was more than 12 times that from gas casualties. In addition to the fact that whilst few of the gas casualties appeared to suffer any permanent disablement a large number of those injured by explosives were permanently mutilated.

The chemical weapon in the form of tear gas has also been introduced for police purposes notably in the United States where it has been employed for dispersing riotous assemblies and for compelling the surrender of armed bandits whose arrest might otherwise involve danger to the police forces.

The substances which have been and may be used in chemical warfare may be divided into (i) pulmonary irritants (ii) vesicants (substances causing blisters) (iii) lachrymators (substances causing profuse weeping) (iv) sternutators (substances causing violent sneezing).

Chlorine belongs to class (i) a powerful lung irritant. Other substances with a similar action are phosgene and chloropicrin ( $CCl_3NO_2$ ).

The physiological action of this group of substances is that they cause considerable oedema (accumulation of fluid) in the lungs so that the victim is almost drowned in his own exudations. The toxic concentration of phosgene is much less than that of chlorine and the subject may not be aware that he is being gassed since symptoms take several hours to develop. Phosgene also has the quality of being more difficult to exclude by means of masks than chlorine. Another lung irritant of this type is trichloromethylchloroformate (Green Cross Gas) which was also used in the World War.

Of (ii) by far the most important and successful is dichlorethyl sulphide popularly known as mustard gas or Yperite. This substance is not a gas at all but a liquid with a high boiling

point. It is filled into shells the bursting of which scatters the liquid in the form of a fine spray. Mustard gas infects everything with which it comes into contact so that after a bombardment with it a stretch of land will be unoccupiable for several days. Even clothing is readily penetrable by the substance which does not give rise to symptoms till several hours after exposure.

The lachrymatory gases comprise a large number of compounds and are non-toxic even in very large concentrations causing merely temporary disablement. They can be ever be completely guarded against by an efficient mask and for this reason their only value in warfare is that of inconveniencing the enemy by compelling continuous wearing of respirators which considerably reduces the efficiency of the troops. The lachrymators are the tear gases used by the police. The principal members of this group are bromoacetone, ethyl iodoacetate, bromobenzyl cyanide, ethyl bromide and chloracetophenone. All these were used during the World War as shell fillings. Lachrymators have an exceedingly rapid action so that unless highly trained soldiers may be so blinded as to be unable to adjust the respirator. If at this moment a toxic gas is discharged a high casualty rate can be obtained.

The sternutating gases are all compounds containing arsenic in organic combination and some of them are extremely toxic. The first to be employed was diphenylchlorarsine (Blue Cross Gas) so named from the shell marking which was introduced by the Germans in 1917. Other similar compounds were later used. These gases were placed in high-explosive shells so that the fine particles into which they were dispersed after the explosion might penetrate the mask worn and by causing violent sneezing and nausea cause it to be removed when the victim would be without protection against the effect of other and more toxic gases with which he could be



simultaneously attacked. These arsenical compounds can be dispersed in the form of toxic smokes formed by the action of heat, and in this form the particles of the irritant are very finely divided and can to some degree penetrate certain types of mask. Like the lachrymators, these gases, whilst causing intense discomfort and pain, give rise only to temporary disablement, and are non-fatal in their effects.

One arsenical, however, in addition to being a sternutator, is also highly toxic and possesses vesicant properties. This is the gas known as "Lewisite," after the inventor. It is the only compound of importance discovered as a result of research during the War, though it had been prepared in an impure form some years earlier. Lewisite ("Death dew") is an extremely powerful vesicant, but as it was invented too late to be of use during the World War, its behaviour under field conditions has not, as yet, been tested. The gases mentioned above were the principal ones employed in the War, although a large number of others were also tried. Since the War a large amount of research has continued in all countries with a view to the manufacture of still more active substances.

The tabulation in the following column gives the principal chemical warfare agents together with their boiling-points and disabling concentrations.

**Defence against Gas.** Troops are protected from gas attacks by a respirator by which the air is freed from toxic substances before being breathed. The early respirators, hurriedly improvised after the first gas attacks, consisted merely of a cloth pad soaked in sodium thiosulphate solution and held over the mouth and nose by a bandage. These, however, were very primitive affairs, and did not give protection against phosgene and other substances that were later brought into use, nor did they protect the eyes. The next development was a helmet that fitted over the entire head, supplied with eye-pieces, with its material soaked in various chemicals

Name of Substance	Boiling point (°C)	Corrosion to cause Temporary Discomfort (parts per million)
<i>Pulmonary irritants.</i>		
Chlorine	-35	100
Phosgene	6	10
Trichloromethyl chloroformate	128	5
Chloroacetic acid	112	5
<i>Lachrymators.</i>		
Dichloroethylsulphide (Mustard gas)	217	c. 1
<i>Lachrymators.</i>		
Ethyl iodide acetate	180	1
Ethyl bromide	58	1
Chloroacetophenone	215	c. 1
Bromoacetone	136	1
<i>Sternutators.</i>		
Diphenylchlorarsine	333	1/2
Diphenylcyanarsine	over 200	1/2
Ethyl dichlorarsine	160	2
β-chlorovinyl dichlorarsine (Lewisite)	190	1/2

so as to give protection against chlorine and phosgene. This mask was efficient up to a point, but was very uncomfortable, and did not protect against other toxic gases.

The next step was the introduction of the box respirator, and this type of protection was used, with small improvements, to the end of the War. It consists of a canister containing the absorbent material connected by a pipe to the face-piece. The latter fits tightly round the face and contains celluloid eye-pieces, a nose-clip to stop breathing through the nose, a mouth-piece by which the air is inspired and an exhaust valve for exhalation. In the later models the inspired air is drawn in over the eye-pieces, so that they should not become clouded by moisture. The most uncomfortable feature of the mask is the nose clip, and in post-war types of respirators this has been dispensed with. The absorbent material in all types of gas-masks is an activated charcoal, since long experiment has shown that this is the best absorbent of toxic gases and particles. In some cases the charcoal is impregnated with a chemical having

a special affinity for some particular gas which may be met with and in some cases soda lime is also mixed with the charcoal to help remove substances of an acidic nature. An important point to bear in mind in the construction of the gas mask and particularly in the choice of an absorbent is that the resistance to breathing should be kept as low as possible since the soldier's efficiency is already handicapped through his being forced to wear a respirator. The best quality charcoal is obtained from the carbonisation of the shells of coconuts. See CARBON.

Protective clothing is of considerable value when mustard gas is being used and for those troops whose duty it is to occupy an area that has been subject to mustard bombardment it is essential. The material employed is some type of oiled fabric.

**Other Phases of Chemical Warfare**  
A chemical warfare method introduced by the Germans in the World War but found to be a failure was the flame-thrower or *Flammenwerfer* consisting of a cylinder of oil from which the liquid was forced through a hose by compressed nitrogen. It was ignited at the mouth of the hose by a chemical mixture and the jet of flame then projected against the enemy. The disadvantages of the apparatus are its very short range and limited duration.

The use of incendiary bombs and shells was developed to a considerable extent and these weapons had a measure of success. There are a large number of incendiary materials that can be used, the usual basis of such a mixture is a highly inflammable compound or mixture such as thermite (aluminium powder and iron oxide), phosphorus etc. which is used to fire a large amount of combustible material such as hydrocarbon oils, tar etc. The most successful incendiary bombs developed during the War consisted of soap (sodium salts of the higher fatty acids) which was ignited by a thermite mixture.

Incendiary bullets which were used against aircraft contained either white phosphorus or a mixture containing a strong oxidising agent such for example as barium peroxide and a combustible such as magnesium. These will probably be of less importance in future owing to the use of non inflammable helium gas in airships and of heavy oil in all types of aircraft in place of the more inflammable petrol. See SMOKE SCREENS.

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**Chemiluminescence** the term applied to the visible light produced by some chemical reactions in the absence of the evolution of any very considerable amount of heat. Most of the reactions that give rise to chemiluminescence are slow oxidations such as the light given out by phosphorus and visible in a dark room. Other reactions that give out a visible cold light are the oxidation of turpentine and the oxidation of pyrogallol under certain conditions. A special class of chemiluminescent phenomena is afforded by the phosphorescence of living organisms such as insects, fungi and bacteria as well as the luminous organs of numerous deep-sea fish. The luminescence in these cases is due to the oxidation of a substance called *luciferin* by a special enzyme or catalyst known as *luciferase*. See also BIOCHEMISTRY.

Several phenomena closely similar to chemiluminescence can be made to occur by physical means. Thus *triboluminescence* is caused by the pulverisation of some crystalline materials such as veronal (diethylmalonylurea), quinine valerate and other organic compounds.

Chemin-de-fer, see BACCARAT

**Chemistry** The scientific study of the composition and laws of matter. In nature we find an infinite diversity of substances. Some 1000 species of minerals are catalogued to-day, from plants we can extract many thousands of kinds of oils and other substances. Modern chemistry can make over 750,000 different substances. Very early in the history of science the notion of an *element* was evolved. Just as thousands of words can be made up from the 26 letters of the alphabet, so, it was rightly supposed, could millions of different substances be made up from a few elements. The first task is to find out what these elements are. The ancient alchemist made a guess which was too simple and yet not simple enough, when he named earth, air, fire, and water. The true answer is that there are 92 elements, but that every one of these 92 is made up of only two original substances, protons and electrons (see ATOM).

Now it is obvious that 26 letters can make countless words only because a word consists of letters arranged in a special way. In the same way our 92 elements make millions of substances only because each substance consists of a special selection of the elements, arranged in a special way. As a matter of fact, we know of a very large number of different substances containing carbon, hydrogen, and oxygen in the same proportions, and yet the substances themselves are different, e.g. formalin, sugar, and starch.

As chemistry began to gain, almost by guesswork, an idea as to what substances were really elements, the two fundamental laws of chemistry were soon discovered. the law of the combination of elements in constant proportion, and the law of their combination in multiple proportion. Twelve parts of the element carbon combine with 16 parts of oxygen to form the very poisonous gas carbon monoxide, 12 parts of carbon combine with 32 parts of oxygen to form the harmless

gas carbon dioxide, which we breathe out of our own bodies. The explanation of these laws was given by the "atomic theory" of the English schoolmaster, Dalton, in 1808. If we imagine carbon to consist of particles all of the same weight, and oxygen also to consist of particles  $16/12$  times the weight of the carbon particle, we can suppose that carbon monoxide is made up of compound particles, consisting of 1 carbon and 1 oxygen particle, while carbon dioxide consists of compound particles containing 1 of carbon and 2 of oxygen. These particles of the elements are called atoms, from a Greek word meaning "indivisible," while those of compounds are called molecules.

Until quite recently it was supposed that the atoms of any single element were all exactly alike, but now we know that this is not the case. We find that they are nearly all mixtures of a number of so-called *isotopes* (q.v.), and that the atomic weight used by the chemist in his calculation is really an average value of the weights of all these atoms. In nearly all cases this average value is exactly the same wherever the element is found, but in a few cases it is possible to obtain an element, lead, for example, with an atomic weight which is different according to the mineral from which it is derived, but nevertheless having identical chemical properties. We are now able to separate elements into their isotopes.

It was soon found that if the elements were arranged in ascending order of atomic weights, elements with similar properties appeared at regular intervals, and the arrangement brought similar elements together in groups. This classification is the *Periodic System*. Slight anomalies appeared in its original form, but these are now eliminated by taking the Atomic Number (usually half the Atomic Weight) as the criterion.

We see from the table that the elements fall into 9 families. In each family the atomic number increases by

Series	Zero Group	Group I	Group II	Group III	Group IV	Group V	Group VI	Group VII	Group VIII
0	—	—	—	—	—	—	—	—	—
1	Hydrogen H = 1.008	—	—	—	—	—	—	—	—
2	Lithium Li = 7.00	—	—	—	—	—	—	—	—
3	Sodium Na = 23.00	—	—	—	—	—	—	—	—
4	Potassium K = 39.1	—	—	—	—	—	—	—	—
5	Copper Cu = 63.6	—	—	—	—	—	—	—	—
6	Rubidium Rb = 85.5	—	—	—	—	—	—	—	—
7	Silver Ag = 107.9	—	—	—	—	—	—	—	—
8	Cadmium Cd = 112.4	—	—	—	—	—	—	—	—
9	—	—	—	—	—	—	—	—	—
10	—	—	—	—	—	—	—	—	—
11	Gold Au = 197.2	—	—	—	—	—	—	—	—
12	—	—	—	—	—	—	—	—	—

8 units, excepting in the case of the first family, or "group," as it is called, where lithium is only 2 units greater than hydrogen. The elements of each group are similar in chemical properties, but we must first discuss the nature of chemical combination before we can properly understand this fact.

It is obvious that if the molecule of a compound is made up of the atoms of certain elements arranged in a certain way, there must be some very definite forces to hold the atoms together. These forces are electrical, as is explained in the article ATOM, but the theory of chemical combination from this point of view is far too complicated and difficult for a work of this character to expound, and we must confine ourselves to a consideration of the simpler notion, *valency*.

According to the theory of valency, the atom of any element is provided with a number of bonds, we can imagine these almost like little magnetic rods sticking out of the atom. An atom possessing only one bond can only form with another atom of its own kind a compound consisting of 2 atoms stuck together by the attraction of the bonds, such atoms are said to be monovalent, and form the first group of the periodic system. Atoms with two bonds are called divalent, one of these can attract 2 monovalent atoms. We have atoms of all valencies up to 8, and a group of elements, helium, etc (see table), with no power of chemical combination at all.

The elements are given symbols, as will be seen from the table, and the composition of compounds is denoted in the following way,  $\text{NaCl}$  is the formula for sodium chloride or common salt,  $\text{CaCl}_2$  is the formula for calcium chloride,  $\text{C}_{12}\text{H}_{22}\text{O}_{11}$  is the formula for cane-sugar, and so on. Many elements possess more than one valency, the position in the Periodic System indicating only the maximum valency. Thus sulphur can be di-, tetra-, or hexavalent. The chemist very soon learns to write most formulae correctly from the rules of valency. The atomic

weight divided by the valency is called the equivalent weight.

It would carry us too far to attempt to show how atomic weights are determined, but one very important matter must be mentioned in this connection. The Italian Avogadro propounded in the year 1811 the hypothesis that equal volumes of all gases contain, at the same temperature and pressure, the same number of molecules (see KINETIC THEORY OF MATTER).

Suppose we know that hydrogen is an element, and oxygen also. If we compare the weights of equal volumes of the two gases, we already have a guide to the relative atomic weight; as a matter of fact we have other reasons for believing that the molecule of hydrogen consists of 2 atoms, and that the same is true of oxygen, in which case a comparison of the relative weight is the same as a comparison of the atomic weight. It will be seen that once we are really on the right track, we can add one deduction to another until the whole of chemistry is covered.

It is obvious that the first problem of the chemist is to isolate pure substances, whether elements or compounds, and we can therefore best understand some of the chief methods employed in chemistry by considering how it is possible to tell whether a given solid, liquid, or gas is a pure substance or a mixture of substances. In the case of the solid our first recourse is to obtain it in a crystalline form, and having done so, to re-crystallise it from a solvent several times. If we find that successive crops of crystals are identical in form, colour, melting-point, and other properties, it is reasonably probable that a chemical compound has been obtained pure. Sometimes, however, we are met with elements so alike in their properties that their compounds form crystals which contain the two elements in varying proportions. This is the case, for example, with radium and barium. We need these to resort to "fractional crystallisation." From a given solution, all the crystals

blamed will be mixed but those first brown down will contain more of one element than those last deposited and by repeatedly separating the crops into fractions and reassembling these a further crystallisation it is finally possible to obtain for instance pure radium bromide from a mixture of radium and radium bromide from which all the other metals associated with radium in the original mineral have been separated.

The purity of a liquid is almost guaranteed by an observation of its boiling point if this does not change during the distillation of the liquid from first to last the liquid is in all probability pure. If it changes we employ what is known as fractional distillation which unlike crystallisation can be developed especially on a technical scale into an automatic process whereby for instance alcohol is obtained pure from its mixture with water.

In the case of a gas we are now able to avoid difficulties by cooling it until liquid or solid and then fractionally distilling. But in earlier times it was necessary to rely upon a measurement of its density which enabled its molecular weight to be calculated by means of Avogadro's Law. If this fitted a formula derived from its elementary analysis it was probable that the gas was pure. Another method employed in the investigation of the rare gases of the atmosphere was to measure the density of the gas carefully and then allow part of it to diffuse through a porous clay pipe stem. The densities of the two parts into which the gas had been thus divided were then compared and if found to be identical the gas was assumed to be pure. The discovery of isotopes (*q.v.*) has led to a greatly increased refinement of this method by which it has been found possible to separate elements into their isotopes.

An important type of reaction is the replacement of one element in a compound by another. For instance when metallic zinc is brought into contact with a solution of copper

sulphate (blue vitriol  $\text{CuSO}_4$ ) metallic copper is thrown down in a red spongy form and zinc sulphate  $\text{ZnSO}_4$  is formed. Finally we have what is known as double decomposition the exchange of partners in the case of two compounds brought in contact. Thus when silver nitrate ( $\text{AgNO}_3$ ) solution is mixed with a solution of common salt ( $\text{NaCl}$ ) we get a white curdy precipitate of silver chloride ( $\text{AgCl}$ ) and we find sodium nitrate ( $\text{NaNO}_3$ ) remaining in solution. This is the commonest type of reaction met with in analytical chemistry. In order to understand why it takes place we need to understand the electrochemical theory of solution (*see* ELECTRO-CHEMISTRY) and also the law of mass action (*see* DYNAMIC THEORY OF MATTER) but it is fairly obvious that if the compounds AB and CD are brought together a tentative exchange of partners to AC and BD may take place. If one of the new pairs immediately takes flight once it is formed it leaves the field open for a continuation of this exchange. Hence a double decomposition always takes place when its result would be to remove by precipitation or evaporation one of the possible compound from the scene of action.

One of the fundamental laws of chemistry is that of the conservation of matter. Until quite recently this was assumed to be the most fundamental of all natural laws but we now know that behind the conservation of mass and energy upon which physics and chemistry were based in the 19th cent. we have a possibility of a conversion of one into the other. But no such conversion takes place in any of the operations which are performed in laboratory or industrial chemistry. The chemist therefore assumes that the chemical balance will if properly used always show that the products resulting from a chemical reaction together weigh exactly as much as the substances taking part in the reaction. If charcoal is burnt in air it appears to vanish completely but by quite simple means we can

demonstrate that the weight of the original charcoal plus the weight of oxygen consumed in combustion is exactly equal to the weight of carbon dioxide produced, together with that of whatever ash the charcoal may leave behind

These facts are expressed by the chemist in what is called a chemical equation. Taking the example already given we write—

$\text{AgNO}_3 + \text{NaCl} = \text{AgCl} + \text{NaNO}_3$ ,  
or, in words, 1 molecule of silver nitrate plus 1 molecule of sodium chloride equals 1 molecule of silver chloride plus 1 molecule of sodium nitrate. If we now turn to a table of atomic weights and look up sodium, silver, chlorine, nitrogen, and oxygen, we can at once write down the relative weights of the substances reacting. Thus silver nitrate ( $\text{AgNO}_3$ ) is given the weight  $\text{Ag} (108) + \text{N} (14) + 3\text{O} (16) = 170$ . In the same way we find for  $\text{NaCl}$  the weight 58.5, for  $\text{AgCl}$ , 143.5, and for  $\text{NaNO}_3$ , 85. These must obviously add up to the same figure on either side of the equation, as must, of course, the number of atoms of each element on either side.

We said at the beginning of this article that chemical compounds were like words, which could be made by the million out of comparatively few letters. We now have to consider the fact, already alluded to, that substances may be different in all their properties, and yet have exactly the same chemical composition. This is possible even in the case of elements, and the phenomenon is known as Allotropy. A most striking instance is that of carbon, which is known to us in the form of diamond (hard transparent crystals), graphite (very soft, almost metallic crystals), and amorphous carbon (soot, ivory black, etc.). Tin is commonly known to us as a silver-white metal, but its more stable form at ordinary temperatures is a grey, non-metallic powder. Oxygen we know as the gas forming a constituent of the air, but also as ozone, a pungent and fairly poisonous substance which it

would be most unsafe to breathe in any considerable amount.

Since in these cases we are dealing only with a single kind of atom, the difference of properties must be due to the arrangement of these atoms. The simplest case is that of oxygen, the ordinary oxygen of the air consisting of 2 atoms combined to form the molecule  $\text{O}_2$ , while ozone consists of 3 atoms forming the molecule  $\text{O}_3$ . We are now in a position to understand allotropy as presented by the solid, such as the diamond and graphite. Here we cannot speak of molecular weight; a crystal, even of a compound, does not possess a molecular weight in the sense that a gas does so, but the atoms are arranged in a regular fashion in which their chemical valencies play a decisive part, and we can readily understand that more than one arrangement is possible, especially in the case of elements such as phosphorus and sulphur, which have several possibilities as regards valency (see CRYSTALLOGRAPHY).

In the case of compounds we obviously have much greater possibilities. We have to remember that the molecule of a compound, unlike the letters forming the word, exists in three dimensions, and that, therefore, within the limitations of valency, a number of different arrangements of the same set of atoms will almost always be theoretically possible. These are called "isomers," this behaviour being referred to as "isomerism." However, these possibilities are rarely realised in inorganic chemistry, the reason being that the compounds of all elements except carbon are tied together so firmly that rearrangement is not easy. Now for any given set of atoms there is one most stable arrangement, and any other arrangement, although possible and stable within limits, will tend to pass into the most stable condition. In organic chemistry (*q.v.*), on the other hand, isomerism plays an enormous part.

The science of chemistry is divided into a number of different branches

Systematic chemistry describes the properties of elements and compounds and how these are prepared and purified. It is divided again into inorganic chemistry which includes the chemistry of all elements excepting carbon and furthermore the subject of mineralogy descriptive of the composition and properties of the identifiable and usually crystalline chemical compounds found in the earth's crust. In this work systematic chemistry is treated under the reference heading of the element and compound. Organic chemistry is the chemistry of the compounds of carbon which by reason of its peculiar and unique properties gives rise to a truly limitless number of compounds any one of which however seemingly unimportant to-day may turn out to-morrow to be of supreme practical importance. Thus the hormones which when present in the human blood-stream in minute quantity have a decisive influence upon health and character are compounds to which no organic chemist a few years ago would have thought of ascribing the slightest importance.

Physical chemistry deals with the energy relationships of chemical reactions from both the thermal and the electrical points of view. From what has been said it will be readily understood that chemical change is a matter of atoms in violent motion under the influence of strong electrical forces. Since we are far from being able to describe exactly what happens even in the case of the simplest chemical reaction we are obliged to approach the subject along parallel routes. The *Kinetico Theory of Matter* (*qv*) deals only with the motion of the atoms and molecules from a statistical point of view. *Thermo-chemistry* (*qv*) and *thermo-dynamics* (*qv*) deal with the energy changes taking place while *electro-chemistry* deals with the study of the electrical phenomena accompanying chemical changes. It should be noted that the energy represented by the separation of any two chemical substances capable of reacting is a

distinct form of potential energy and that this form of energy heat energy and electrical energy are mutually transformable.

**Chemnitz**, German town in Saxony 4.5 m S.E. of Leipzig. It is the leading manufacturing centre of Saxony and third in size after Dresden and Leipzig. Its products include engineering locomotives textiles bleaching and chemicals and it is a popular tourist centre. Pop. 360,000.

**Chemotaxis** [*pr* = *chemotaxis*] (*biol*) is locomotion due to the influence of external chemical agents.

The plasmodia of Myxomycetes (*qv*) move slowly towards dilute extract of tan and away from sugar solutions. Spermatozooids of ferns (*qv*) are attracted to oögonia by malic acid. In mosses (*qv*) the attraction is provided by cane-sugar solution. In both these cases Chemotaxis is an aid to fertilisation. Zoospores of fungi (*qv*) of the genus *Saprolegnia* swim towards infusions of meat and insects and the products of their putrefaction is food but the zoospores swim equally well to solutions of poisons fatal to them. Bacteria in the vicinity of solutions of potassium salts move toward them. Traces of oxygen attract some bacteria. In all cases of Chemotaxis the concentration is as important as the nature of the medium. Organisms moving towards a medium of appropriate concentration generally low will move away if the concentration be unsuitable. Movement towards a chemical agent is positive movement away from it negative chemotaxis. The complete explanation of the phenomenon is unknown. See also **CHEMOTROPISM**.

**Chemotherapy** may be defined as the science of curing disease by chemical method.

Modern chemotherapy may be said to have been founded by the work of the German chemist Paul Ehrlich (1854-1915) who was led to his researches on the parasitocidal action of drugs by the discovery that certain



dyes had the power to kill protozoa

The search for new and more potent chemotherapeutic agents is carried out by preparing new substances and testing their effect on laboratory animals who have been infected with the disease that it is desired to cure. Whilst the reactions of the lower animals and man both to diseases and to drugs differ, they are sufficiently similar to enable it to be judged whether there are sufficient favourable data to justify clinical trial.

Some of the earliest researches of Ehrlich were with a view to finding a cure for syphilis, and whilst his expectations in this direction have not as yet been fulfilled, numerous substances are available which have a favourable effect on the trend of the disease, especially if used early, and these will, on prolonged treatment, even cure it. The most satisfactory animals for infection with the disease are rabbits, and it is these that are principally employed in laboratories.

A disease whose causative organism is very similar to that of syphilis is trypanosomiasis, more commonly known as sleeping sickness (to be distinguished from sleepy sickness or *encephalitis lethargica*) which is extremely widespread in tropical Africa, and attacks both man and cattle. The drugs which are used to combat this are somewhat similar in constitution to those employed against syphilis, being organic arsenic compounds in which the arsenic is pentavalent (in contrast to the majority of anti-syphilitic drugs, where it is trivalent), the most widely used preparation being triarsamide or sodium-*n*-phenylglycineamide-*p*-arsinate.

Another compound of a different type which is widely used against sleeping sickness is a German drug known as "Bayer 205" (Germanin) which, although its composition has not been disclosed, is believed to be identical with the French preparation designated as "Fourneau 309" (Moranyl), which is a urea derivative.

These compounds are utilised to

combat sleeping sickness both in men and animals. In the case of the latter considerable success has also been achieved by the use of antimony compounds, tartar emetic being the one most frequently employed.

A disease in the cure of which very considerable advances have been made within the last 20 years is leprosy. This, although almost extinct in Europe, is still an important factor in the Orient, where several millions of people are afflicted by it. Recent work has shown that cures can be effected by the injection of the active principles of certain vegetable fatty oils such as chaulmoogra and hydnocarpus, and very considerable progress has been made in this direction (*see OILS, FATS, AND WAXES*).

The treatment of malaria has attracted the attention of research workers in the effort to find a drug which would be more effective than quinine (*qv*), which has been used for this purpose either in the pure form or else as an extract of cinchona bark for over three centuries. So far, however, no substance has been discovered which is even as good as quinine in this respect, the nearest approach is a synthetic substance named plasmoquin which has a structure in some ways similar to that of quinine. Although as stated this substance is not so active against malaria as is quinine, it is of use to those people who are abnormally sensitive to quinine and to pregnant women in whom the employment of quinine may cause abortion. The alkaloid harmaline is also of some effect, especially in cases of recurrent malaria.

One of the principal victories of chemotherapy has been in the fight against helminthic infections (worms). The most prevalent of these is hookworm or uncinariasis, which is widespread in tropical and sub-tropical areas such as, for instance, the W. Indies and S. U.S.A. The worm infects the body usually through the foot, and the eggs are excreted in the

faces which if not properly disposed of infect the ground where the eggs hatch and thus complete the cycle.

The destruction of the worm inside the body can be accomplished by a number of substances the principal of which are carbon tetrachloride thymol and oil of chenopodium. The latter is an essential oil obtained from a certain tropical plant. Tetrachloroethylene also is of value.

With regard to the chemotherapeutic treatment of cancer little progress has been made (with of course the important exception of the effect of radioactive chemicals see RADIOACTIVITY) but it may be of interest to note that the injection of colloidal lead has been stated to have beneficial effects. See also ANTISEPTICS.

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**Chemotropism** (biol.) a growth movement due to the influence of chemical agents. Fungal hyphae grow away from their own staling products; this reaction results in the formation of fairy rings which increase gradually in size as the fungi (*q.v.*) recede from their original centre. Pollen tubes will grow towards solutions of sugar and glycerine of appropriate concentration. Roots also are chemotropic. Chemotropism may be positive or negative. See also CHEMOAXIS.

**Chemipo** open port on the W coast of Korea. It is a busy export entrepot and trades in skins, beans and other native produce. The harbour is sheltered. The Russo-Japanese War began here. Pop. (1930) 84,000.

**Chenab** (1) Indian river (c. 500 m.) in the Punjab; it rises in Kashmir and flows in a generally S direction joining several other streams which together

form the main tributary of the Sutlej shortly before it joins the Indus. (2) The name of a large and well irrigated district through which the river flows. It is c. 3,000 sq. m. in extent and has a pop. of 980,000. Includes the town of Lyallpur (pop. 28,000).

**Cheng tu**, capital of the Sze chwan province of China. It lies in the centre of a well irrigated plain and is the first city of W. China in commercial and cultural importance and the seat of the W. China Union University. There is a trade in silk and fruit and great quantities of rice for local consumption are grown on the plain. Pop. c. 890,000.

**Chénier André Marie de** (1762-1794) French lyric poet who offended the Revolutionaries by his writings and was guillotined. His best poems were unknown during his lifetime but were published posthumously; they are *La Jeune Captive* and the *Iambes* and were written in prison. His political poems include *Jeu de l'homme* (1790), *Sur les Suisses révoltés*, *Ode à Charlotte Corday* and *Ode à Versailles*. He has been variously described as the first of the 19th-cent. romantic and the last of the 18th-cent. classical poets.

**Chenopodiaceae** a dicotyledonous family of herbaceous or somewhat shrubby plants with leaves inclined to be fleshy; the flowers are small and inconspicuous; the perianth decidedly partaking of the characters of a calyx which sometimes has a tendency to become enlarged in the fruit. They are common weeds in many temperate climates and are most abundant in salt marshes and on the seashore. Many of the plants of this order are eaten—as spinach, beet, and orach. A variety of beet forms a valuable food for cattle under the name of mangold wurzel. Popular garden flowers belonging to this family are love-lies-bleeding, prince's feather and cockscomb.

**Chenopodium** [κένωρον δρυμ] or Goose foot genus of plants related to beet, mangold wurzel and spinach. The wild representatives are common

notable musical theorist, was born in Florence, and early showed precocious musical gifts, having composed many ambitious works by the time he was 17. After the production of his first opera in 1780 he went to London, where two new operas, *La Finta Principessa* and *Giulio Sabino*, were produced. *Iphigénie en Aulide* followed at Turin in 1788. The same year saw the production in Paris of this opera which was the first of the series that represented an original and brilliant era in the history of French opera. Cherubini's great technical powers and original style were given even greater scope in the operas that followed—*Lodoiska* (1791), *Médée* (1797), *Der Wasserträger* (1801), and *Faniska* (1806). One of Cherubini's most fervent admirers was Beethoven, whom he met during a stay in Vienna.

Besides some 30 operas, Cherubini wrote cantatas, masses, requiems, and much orchestral, chamber, and piano-forte music. His *Treatise on Counterpoint* (1837) is one of the most famous works on musical theory.

Chervonetz, the current monetary unit in Russia, introduced in 1922 under the New Economic Policy to supersede the old depreciated roubles, 10 gold roubles being equal to a chervonetz. The new currency, which was backed to the extent of 25 per cent in gold, platinum and foreign currency, and 75 per cent by goods, bills of exchange and short-term securities, was used only as an official and international unit. For internal use rouble notes were issued, but soon depreciated to a negligible value. In 1924 the budget was balanced, and new rouble notes were issued, their volume being limited to half the number of chervonetz. This system has been maintained in a stable condition ever since. The par value of the chervonetz is 21s 2d, its average value in the summer of 1933 being 31s.

"Chesapeake," see "SHANNON" AND "CHESAPEAKE"

Cheshire, English county in the N.W., bounded N by the Mersey and

Lancs, S by Shropshire, S.E. and E by Staffs and Derbyshire, and W by Flintshire, Denbigh, and the Irish Sea. Cheshire includes the Wirral peninsula between the rivers Dee and Mersey. The surface, composed almost entirely of Jurassic rocks, is mainly flat, the only hills of note being the Peckforton, which average only c. 600 ft. The principal river is the Weaver, the Dee though on the W. border, is not strictly within the county.

Cheshire is both agricultural and industrial. Its cheese-making industry goes back as far as the 12th cent., oats are extensively grown. Dairy farming, stimulated by such large markets as Manchester, Liverpool, and Stockport, is considerable. Fruit-growing includes strawberries and damsons.

To the N. of the county there is an extension of the Lancashire coalfield, many towns engage in cotton-spinning and metal casting. Birkenhead and Crewe are respectively shipbuilding and engineering centres. On the Mersey there are flour-mills and iron-works, and the great soap factories of Port Sunlight are important. There are large deposits of salt, and this industry is one of the oldest and most valuable.

Among the largest towns are Chester (qv, the county town), Birkenhead (147,946), Stockport (125,505), Wallasey (97,465), Crewe (46,061), and Macclesfield (34,902). Communications throughout the county are good, especially canal traffic, including the Manchester Ship, Grand Trunk, and Shropshire Union Canals. Area, 1020 sq. m., pop. 1,087,544.

Chesil Bank, a narrow and lengthy spit of shingle on the Dorset coast, running parallel with the coast and reaching from the Isle of Portland to Bridport (18 m.).

Chesney, Francis Rawdon (1789-1872), British general and explorer. His favourable report on the Suez Canal proposal, 1830, was the basis of de Lesseps' work. He proved the practicability of a new route to India along the Euphrates Valley to the Persian Gulf, 1831-6.

**Chess** (Persian *Shah* king) an ancient game of uncertain origin it was likely it was first played in India and introduced into Persia in the 6th cent A.D. The earliest treatise on the game was written in Arabic in 900. The date and manner of its introduction into Europe are also obscure but there is no reliable evidence that it was played earlier than the 11th cent. The modern form of the game dates from the 16th cent and the earliest important work on the subject was written in 1501 by a Spaniard Ruy Lopez de Segura whose name is honoured in a famous opening. The first international chess tournament was held in London in 1851.

The numerous local leagues and associations combined as the *British Chess Federation* in 1901 in which year the first British championship meeting was held.

Since 1896 matches between Great Britain and USA have been played annually by cable. Dr A. Alekhine became world champion in 1929.

The game is played on a rectangular board divided into 64 squares light and dark alternately with 8 pieces and pawns on each side. The pieces comprise King, Queen, 2 Rooks or Castles, 2 Bishops and 2 Knights. The conventional signs used to indicate the pieces are

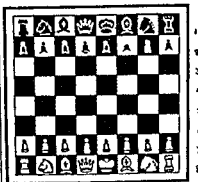


Each set of men is black or red (Black) the other white or yellow (White). The arrangement of the board at the opening of a game is shown in the illustration. The queens stand opposite to each other, black on a black square and white on a white square. The kings also stand opposite to each other. For the purpose of recording games a special notation is used. The pieces on the king's side of the board are known as king's bishop, knight and rook (KB, Kkt and KR) those on the queen's side as queen's (QB, Qkt

QR). The vertical files of squares are called after the pieces originally occupying the end square of the file (see Fig.) and numbered 1-8, thus the left hand vertical file (*white*) is known as QR1, QR2, and so on to QR8, the next file is QKt1-8 and so on. For *black* the order is reversed the right hand file being QR and the left hand file KR.

**The Moves.** Each piece has its own peculiar move and (the Kt excepted) can capture and remove from the board any opposing piece in its path (except the K) by occupying the square on

BLACK



WHITE

Opening Position.

which the captured piece stood. The pawns at the first move may move 1 or 2 squares straight forward at subsequent moves only 1 square. The pawns cannot take pieces on their direct path but only those standing on the square diagonally in front on either side. The pawn occupies the square on which the captured piece stood and on its next move—moves straight forward on the new file. A pawn on its 5th rank may take an opposing pawn en passant if it attempts to pass by making an opening move of 2 squares. The capturing pawn then occupies the square on which the captured pawn

would have stood if it had moved only 1 square. A pawn cannot be taken *en passant* by any piece other than a pawn. The *rook* can move any number of squares straight forward, backward, or sideways, but *not diagonally*. The *bishop* can move any number of squares forward or backward, but *only diagonally*. It is thus always on a square of the same colour as that on which it first stood. The *queen* combines these moves, and can move any number of squares straight forward, backward, or sideways, or forward or backward diagonally. The *king* can also move forward, backward, sideways, or diagonally, but only 1 square at a time. The *knight* has a peculiar L-shaped move, 2 squares straight forward, backward, or sideways, followed by 1 square either to left or right. The knights alone have the privilege of jumping over any pieces in their path. They are thus the only pieces which can be moved at the beginning of a game without the preliminary move of a pawn. A knight in the open can move to any one of 8 squares, but in a corner he has only two alternatives, knights, therefore, have more power the nearer they are to the middle of the board.

**Castling.** If there are no pieces between the king and either of the rooks, if neither has yet been moved,



Castling

and if no intervening square is commanded by a hostile piece and the king is not at the time in check, the king may move two squares towards the rook, and the rook to the square on the farther side of the king. For instance, the king might castle with either rook; if he did so with queen's rook, K would move from K1 to Q1, and the rook from Q1 to Q1, if with king's rook, the king would move to K1, and the rook to K1.

**Queened Pawns.** If a pawn reaches the end square of any file, it must be exchanged for any piece from knight to queen, whether such piece has been already captured or not.

The king cannot be captured, but the object of the game is to force the opposing king into such a position that were he a capturable piece, he would be captured, the king is then said to be *checkmated* or *mated*, and the opposing side wins. If a piece is moved into such a position that it could take the king on the next move, the player must announce "*check*," and the king must then immediately be moved out of check, or protected by the interposition of another piece, or by the capture of the opposing piece which has given check. If none of these things can be done, the king is mated and the game lost. If the king, not being in check, cannot move without going into check, and no other piece can be moved without putting the king in check, the game is drawn (*stalemate*). If the king is in check, and the pieces in such a position that the check may be indefinitely repeated without producing checkmate, the game is drawn (*perpetual check*). There are a very large number of conventional methods of opening the game, most of which have been analysed as far as the 10th move, and an appropriate defence—in some cases many—has been evolved for each. An opening offering the sacrifice of a piece is known as a *gambit*. Players usually select one or two openings which they have learnt from experience they can manage best, and specialise in them and their variations.

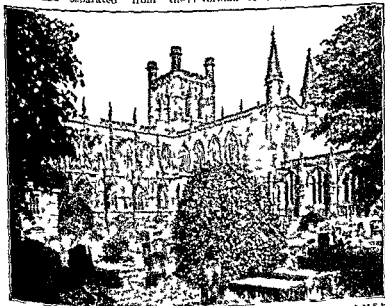
**Chest,** a large box with a hinged lid chiefly used to store household linen, clothes, ecclesiastical vestments, or valuables. Chests were the predecessors of chests-of-drawers, trunks, and wardrobes, and in the early Middle Ages were often covered with richly decorated leather. Many fine Jacobean specimens are extant, with fine carved wood panels. Chests used as strong boxes were often made of

on, with most elaborate locks of such the Domesday Chest at the Public Record Office is an interesting example. An Italian variety were he lavishly decorated marriage offers (carsons) for a bridal trousseau presented to-day in the United States by the cedar lined Hope chests.

Chest, that part of the body which is enclosed by the ribs and intercostal muscles and separated from the

abdomen. See also HEART RESPIRATION BRONCHITIS PNEUMONIA ETC

Chester county town of Cheshire situated near the mouth of the R. Dee 16 m SW of Birkenhead. There are numerous industries including clothing, brewing, metal working and tobacco. Chester is famous for its city walls (the best preserved in England), its red sandstone cathedral (Norman to Perpendicular) and its



Chest Cathedral

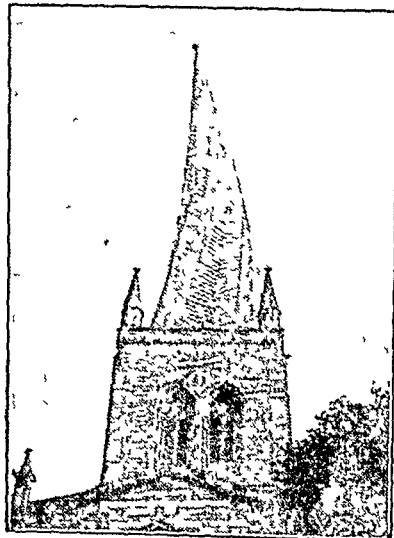
(Courtesy L.N.S.R.)

abdomen by a powerful dome-shaped muscle called the diaphragm. The chest contains the lungs and the heart together with their associated structures the bronchial tubes and the larger blood vessels. It also contains the oesophagus or food pipe which conducts food from the mouth through the chest into the abdomen. The structures in the chest are covered by a membrane called the pleura which is analogous to the peritoneum of the

Roofs or arcades along the fronts of the houses. It was the headquarters of a Roman legion and until the Dee silted up a port of some importance. Pop 41,433.

Chesterfield, industrial town in Derbyshire c 15 m S of Sheffield. The principal manufactures are machinery, textiles, metal founding and earthenware. Of special architectural interest is the twinned spire of St Mary's Church. There is a

memorial hall to George Stephenson  
Pop 64,146



Chesterfield St Mary's Church

**Chesterfield, Philip Dormer Stanhope, 4th Earl of (1694-1773)**, English politician and man of letters. He is known to-day for his *Letters to his Son* and *Letters to his Godson*, in which his brilliant wit and wise epigrams are seen at their best.

**Chester-le-Street**, coal-mining town in county Durham, 6 m N of Durham city. It was a bishopric in the 9th cent. Pop (1931) 16,639.

**Chesterton, Gilbert Keith (b 1874)**, English author, began his literary career as a journalist. His virile attacks on the decadent movements of the late Victorian era, published in *Twelve Types* (1902) and *Heretics* (1905), and his critical essays, *Robert Browning* (1903) and *Charles Dickens* (1906), established his reputation. He then began a series of works that expressed his philosophy in terms of popular fiction, e.g. *The Napoleon of Notting Hill* (1904), *The Man who was Thursday* (1908), and later *The Man who knew too much* (1922), *The Father*

*Brown stories*, *The Flying Inn* (1914) and *The Port and the Lunatics* (1929). He also wrote much verse, of which *Lepanto* and *The Ballad of the White Horse* (both 1911) are probably the best-known examples. His brilliant style, which combines vigour and wit, and his excellent detective stories, have earned him great popularity among all classes. Few writers have been so capable of expressing economic, political, and religious argument in an interesting and amusing fictional form.

**Chestnut**, a tree of the genus *Castanea* and family *Fagaceae* cultivated in the S counties of England for its fruit and timber. Several varieties are grown. The Downton and the Prolific are the most valued for their hardness. Any free upland soil is suitable if it is not too adhesive. Little if any pruning is necessary, the fruit being all produced in clusters on the ends of the shoots. See also HORSE CHESTNUT.

**Chetwode, Sir Philip Walhouse, Bt (b 1869)**, British general. He won distinction in Egypt and Palestine in the World War. As commander of the 20th Corps in 1917-18 he participated in the capture of Jerusalem and in Allenby's final victory.

**Chevalier, Albert (1861-1923)**, English music-hall comedian, celebrated for his coster sketches and songs, including *My Old Dutch*.

**Chevalier, Maurice (b 1899)**, French singer and film actor, first appeared as a singer, 1906, acted in revue at the Folies-Bergère 1910-13, appeared at Palace Theatre, London, 1919, in *Hullo, America*, began his film career 1929, and has appeared in *The Love Parade*, *The Big Pond*, *A Bed-time Story*, etc.

**Chevet**, see APSE.

**Cheviot Hills**, the historic boundary between England and Scotland, scene of centuries of border warfare. The Cheviots extend between Northumberland and Roxburghshire for a distance of some 40 m, the greater length being in England. They are mainly composed of Old Red sandstone granite, and carboniferous limestone.

The chief peaks include Cheviot (2680 ft.) Windygate Hill (2040 ft.) and Peel Fell (1970 ft.) The hills contain the sources of the Coquet Till and several Tweed tributaries. Many of the slopes are grass-covered and a famous breed of sheep is reared there.

**Chevron**, *see* HERALDRY

**Chevrolet**, *see* MOUSE DEER

**Chevy Chase** an unimportant border skirmish at Otterburn in 1388 remembered through the excellent "Ballad of Chevy Chase" which described the battle.

**Chewing Gum**. The basis of chewing gum is chicle the coagulated latex or milky sap of a tropical American tree the sapodilla (*Sapota achras*) which was first used as a rubber substitute. The gum consists simply of chicle flavoured with various ingredients incorporated with it by heat. Paraffin wax and white wax are also frequently added as well as balsams of Tolu or Peru and sugar.

**Cheyenne** [ʃəˈiːn] capital of Wyoming State U.S.A. near the S border and due N of Denver. It is a typically Western city and an important market centre for the surrounding districts. Local industries include meat packing the transport of cattle and a general trade in agricultural commodities. Pop. (1931) 17,300.

**Cheyne-Stokes Respiration**, an abnormal type of respiration in which the breathing increases in depth then shallows and ceases entirely beginning again and repeating the cycle after a pause of perhaps half a minute. It is caused by an affection of the respiratory centre in the brain due to meningitis intoxication or other causes and respiration is only affected when the amount of carbon dioxide in the blood has risen to an extent sufficient to provide a stimulus. The danger is that the continued exhaustion of the respiratory centre will in time prevent it responding to any stimulus.

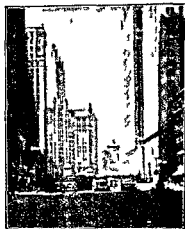
**Chhattisgarh**, division in the E of the Central Provinces of British India. Much of the district consists of a great plain watered by the Mahanadi R.

Huge rice crops are normally produced in spite of backward methods and scant irrigation. Some wheat is grown and cattle are raised. Most of the natives are Hindus. Area 2,000 sq. m. pop. c. 3,400,000.

**Chiang Kai shek** (b. 1886) Chinese general. On Sun Yat-sen's death in 1925 Chi ng kai-shek was appointed Commander in Chief. His defeat of Chen Chiang-ming led to the formation of the Nationalist Government and in 1926 he established an administration at Wuchang. Following his break with the Soviet the Government was transferred to Nanking 1927 and from 1928-30 he acted as constitutional President of the Republic.

**Chiaroscuro** *see* ART TERMS GLOSSARY OF

**Chicago** city in Illinois U.S.A. at the S.W. end of Lake Michigan. In population commercial importance and as a railway centre it is one of the greatest cities of the U.S. Its exceptionally favourable position makes it an important export centre for the agricultural products of the W. and the neighbourhood of valuable mineral deposits decides its leading manu-



Chicago Michigan A scene

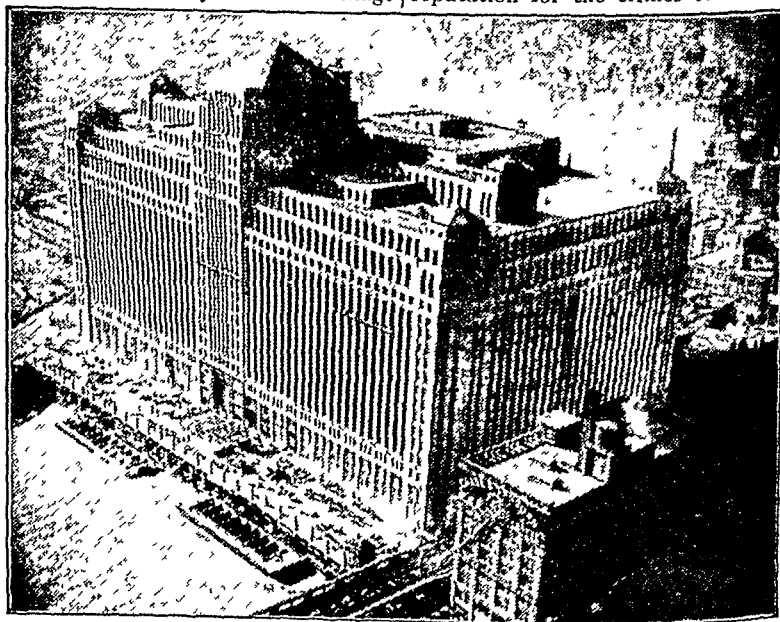


factures Meat packing, grain, and flour-milling produce an enormous revenue, and iron and steel goods, engineering, cement-making, and many other industries are almost as important. Traffic both by rail and by water is very heavy, and the city is rapidly developing as an air port. There are many magnificent parks and public buildings.

Chicago was only a small village

the total number of inhabitants is 3,350,000. The area of the city and its environs is more than 1100 sq. m. A great fire devastated the city in 1871, since when a large town-planning scheme has been in operation which will not be completed for another 20 years.

While Prohibition Laws were in force Chicago gained an unwelcome reputation for the crimes of violence.



Chicago Merchandise Mart

as late as 1830, but since the end of the 19th cent the growth of the city has been phenomenal. Though of late years rivalled by other growing cities in the district, Chicago still keeps its leading position, and is second only to New York in the volume of its business. The population is very mixed, including more than 25 per cent of foreign immigrants, and a great negro section, with more than 250,000 of mixed parentage. About 700,000 are native (American) Chicagoans, and

carried out by organised gangs under various leaders.

**Chicheley, Henry** (c. 1362-1443), Archbishop of Canterbury, remembered for his work as an educationalist. He founded colleges at Oxford and elsewhere, and represented the Convocation of Canterbury at the Council of Pisa, 1409. He was also a diplomatist, going on missions to the Pope and to the King of France, with whom he arranged peace terms in 1413.

**Chichenitza**, ancient city of Yuca-

San N. N. so called from two holy wells, the centre of the Mayan religion. The city was founded c. A.D. 400 and by the 16th cent. was a great cultural and religious centre of the Maya civilisation. It is noted for its remarkable architecture of which striking ruins exist.

**Chichester** (pronounced CHICH-ster) **Georgy Vassilievich** (b. 187-) Russian diplomat joined the Social Revolutionary Party in 1901 and lived in exile in Germany and elsewhere until after the Bolshevik revolution. While abroad he became a member of the Russian Social Democratic Party. In England during the World War he was imprisoned in 1917 for his revolutionary and anti-war activities in London. On his release in January 1918 he returned to Russia and became People's Commissar for Foreign Affairs. He retained this position until 1929 leading the Russian delegation at the Genoa Conference in 1922 when his success in concluding the Treaty of Rapallo between Germany and the Soviet Union contributed to the failure of the Conference.

**Chichester** capital of W. Sussex. Various agricultural industries are carried on and there is a cattle market. The town was famed in the 14th cent. for its markets and woollen industry. Buildings of note are the Cathedral (11th cent.) with its detached bell-tower, St Mary's Hospital and the Guildhall. Parts of the ancient walls remain and the market cross is one of the finest in the country. Pop. (1931) 13,911.

**Chicken pox**, one of the most catching diseases known attacks so suddenly that the rash appears on the skin before the patient begins to feel ill.

The cause of the disease is not a germ but a *virus* (qv) which is so small that it cannot be seen under the most powerful microscopes or build up by the finest of filters.

There is a definite connection between chicken pox and another disease known as *herpes zoster* in which

areas of the skin become covered by numerous small herpes or blisters. Furthermore there is a very close similarity between these two conditions and smallpox and vaccinia. Smallpox is also due to a filterable virus and in appearance very closely resembles chicken pox and just as chicken pox can become modified into herpes zoster so can smallpox become modified into vaccinia. When calves are infected with human smallpox its modified form vaccinia develops in them in place of smallpox. When human beings are infected with vaccinia by scratching calf lymph into their skin then they become protected against smallpox a process known as vaccination. Such a protective mechanism has not yet been discovered in the case of chicken pox.

Chicken pox is known technically as varicella. Epidemics are very common and the disease once it starts usually spreads with great rapidity. The rash comes out in successive

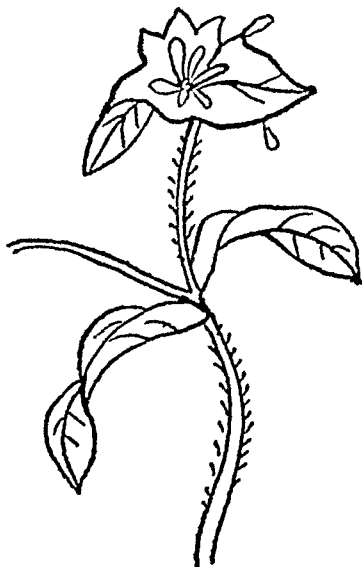


Chichester Cathedral.

crops—a very distinguishing feature of the complaint. It is usually also most dense towards the centre of the body, namely, upon the chest and abdomen and upper parts of the limbs. In smallpox, on the contrary, all the spots come out at the same time, and are more thickly distributed away from the centre of the body, on the face, forearms, and feet.

Chicken-pox is not normally a notifiable disease, but from the public health aspect its chief importance lies in the possibility of its confusion with smallpox. The two conditions are distinguished by consideration of the rash, as outlined above. Nevertheless, it is sometimes very difficult to make a definite diagnosis, and for this reason chicken-pox is often made notifiable at periods of a smallpox epidemic.

Chickweed, one of the commonest



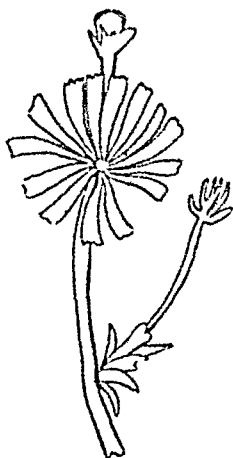
Chickweed

weeds, downy and generally viscid, with straggling branched stems 1-2

ft long and inconspicuous white flowers, which bloom throughout the summer.

**Chicle, *see* CHEWING GUM**

**Chicory** is cultivated for its leaves as a salad, but more frequently for its roots, which are roasted and mixed with coffee. A blue dye is obtained from the leaves. The plant is found wild on chalky soils and is easily distinguished by its large blue sessile flower heads, of which each floret is 5-toothed,



Chicory

and its tough, angled, alternately branched stems, and clasping leaves.

**Chief, *see* HERALDRY**

**Chiemsee (*Bayrisches Meer*)**, large Bavarian lake, c 30 sq m in area. It contains three islands, upon one of which are the ruins of a famous castle; this island was a bishopric from the early 13th cent. The lake is a popular pleasure resort.

**Chieti [*pron* KEATI]**, Central Italian department, part of Abruzzi. Much of it is mountainous, but in the valleys, and on the coastal plain good crops of grapes, olives, and wheat are raised. Industries are fishing, and textile and leather manufactures. Area, 1000 sq. m. The capital, also called Chieti, has a Gothic cathedral, and the remains of a Roman theatre and temple. Pop. department, 359,000 (1931); town, c 18,000.

**Chiffchaff, *see* WILLOW WARBLER**

**Chiffonier**, originally a work-table for embroidery. In the 18th cent no drawing-room was complete without an ornamental stand, often of bamboo,

Chih li

whereon souvenirs were displayed. A variation was the what not having shelves for bric a brac.

Chih li Chinese province bounded N by Inner Mongolia and S by Shan tung. The surface consists of extensions of the Mongolian Mountains in the N and a large plain running into the Gulf of Ie-chih li in the E.

S. Though well watered by the Lwan hu Iu to-ho and other rivers the province is not very fertile. There is scarcely any rice grown and only moderate quantities of wheat and other cereals. Other crops are cotton and beans. Coal is worked in the district of Kai ping. The chief towns are Peiping (the old capital Peking) Tientsin and Iao-ting fu. Area 145 300 sq m. pop c 30 000 000.

Chihuahua, mountainous State of Mexico bounded N by New Mexico and E by Texas. The surface slopes W to E and the high valleys are fertile much of the E is a barren plateau. The principal occupation is cattle raising. Minerals include gold and silver and the mining industry is very important. The capital Chihuahua stands in a valley of the Sierra Madre. Pop c 38 000. Mining cotton weaving and the manufacture of gunpowder for blasting are the main industries. The town was founded in the early 18th cent as a mining settlement. Area of State 90 000 sq m. pop (1930) 490 000.

Chilblains a mild type of frostbite generally affecting the fingers or toes causing inflammation redness itching and swelling of the affected part and usually due to rapid change of temperature and favoured by defects in the circulatory system. Where the latter condition is suspected a heart tonic is useful and in all cases local application of ichthyol or formalin ointment of strength varying according to the texture of the patient's skin should be resorted to. The patient should avoid washing in very hot or cold water.

Child by law a person under the age of 14. Medically infancy is the period of life during which the child is

normally at the breast. Childhood is the period of life from the first year until puberty. The Children Act of 1908 inflicts heavy punishments for cruelty against children. Parents or guardians must provide adequate clothing food lodging and medical aid. All persons receiving infants for re-ard must register with the Local Authority and receive periodic visits of inspection. The Act regards the procuring of a child for purposes of begging or immorality as an offence. The sale of cigarettes to persons under the age of 16 years is forbidden and any police-constable or park keeper in uniform has the right to seize cigarettes in the possession of a child in public places. The Education Act of 1918 states that no child under 12 can be employed and no child under 14 may be employed in street trades factory workshop mine or quarry. Sentence of death cannot be pronounced on a child. The maximum punishment is detention during His Majesty's pleasure.

Children's courts were created in 1908 for persons under 16 with the object of sparing them the degradation of the police cell and the criminal court.

*Infanticide* the killing of a child at or soon after birth. It ranks with murder but a verdict of manslaughter may be returned if mental disturbance at the time of the crime can be proved.

*A Live Birth* a child which has completely proceeded in a living state from the body of its mother. The law does not regard a living child in its mother's womb as a human being.

*Still birth* a child which has issued forth from its mother after the 28th week of pregnancy and which has not at any time after being completely expelled breathed or shown any other signs of life. After the 28th week of pregnancy a child is said to be viable capable of living separate from its mother. The main evidence of a separate existence of the child is proof that respiration has taken place.

The average weight of a mature infant at birth is 7 lb. Roughly

speaking, a child doubles its weight in 6 months and trebles its weight in 1 year and the subsequent gain in weight is at the average rate of  $4\frac{1}{2}$  lb per year. The height at birth is 18 in, which at the end of the first year has increased to 28 in. The circumference of the head of the new-born child should be 13 in. A child should sit up at 6 months, walk at 12, and walk well at 2 years, be dry all the day at one year and all night at 2 years and have control over its bowels after 1 year, it should chew at 6 months, chew well at 1 year, feed itself cleanly at 2 years, it should follow a light with its eyes at 1 month, know people and objects at 3 months, say single words at 1 year, string words together at 2 years, say nursery rhymes at 3 years, and have an idea of reading and writing at 5 years.

The order of eruption of the temporary or milk teeth is central incisors at 6 months, lateral incisors, 9 months, canine, 12 months, first molar, 18 months, second molar, 24 months. The permanent teeth erupt in this order at yearly intervals: first molar (at 6 years), central incisor, lateral incisor, first premolar, second premolar, canine, second molar, and the third molar (wisdom), after 17 years.

**Sleep.** A new-born child sleeps except when being fed and changed. At 1 month, 22 hours sleep are required; at 6 months, 18 hours, at 1 year, 14 hours, at 2 years, 13, and from 4 years upward, 12 hours.

**Feeding.** Breast milk is the only food which supplies all the requirements of the infant. A baby should be fed at the mother's breast in normal circumstances. A nervous mother does not make a good nurse, and frequently failure to suckle a child is due to want of perseverance. A child should be weaned by the 9th month, mixed feeds being given after 6 months. The only justification for weaning a child earlier is its failing to gain weight.

**Artificial Feeding.** Substitutes for breast milk are cow's milk, full cream dried milk, "humanised" dried

milk, condensed milk, both sweetened and unsweetened, and starchy proprietary foods. Children require plenty of water to drink. Tea and coffee should never be given before the age of 8, unless suitably diluted. Regularity of meals should always be enforced, and children should be taught early to masticate their food properly. Clothing should be light and porous, and the amount required should depend on the warmth of the day, not on the time of the year.

**Chief ailments** are Rickets, diarrhoea and vomiting, tuberculosis, meningitis, rheumatism, and such acute infectious diseases as measles, whooping-cough, scarlet fever, mumps, and chicken-pox. These are dealt with in detail under their various headings.

**Infant Mortality.** The number of infants dying under 1 year of age per 1000 of infants born during the last 30 years has steadily fallen. Until 1900, the average annual rate in England was 153, in 1913, just over 100, in 1920, 80, in 1923, 70, and in 1931, 66. Comparative statistics for various capitals for 1929 (the latest available) are: London 70, New York 60, Paris 100, Berlin 85, Vienna 80, Moscow 130.

**Welfare centres** are consulting-rooms for advice in the care of children, which have sprung into existence during the last 30 years. In co-operation with the hospitals, they maintain a high standard of health in infants and young children of their particular district, educate the mothers, and discover early signs of disease which can then be promptly treated or eradicated by hospital or private doctors.

A child's early impressions and experiences profoundly influence its character. Many books have been written on child guidance and child psychology, and the question whether a child's plastic mind should be moulded on traditional lines or whether it should be allowed absolute freedom is still hotly disputed between advocates of opposing systems.

**Child, Sir Francis** (161 -1713) Eng sh banker. He began as a goldsmith and about 1671 founded Child's Bank. He lent money to the Government and was knighted in 1689 and became Lord Mayor of London in 1698.

**Child, Francis James** (185-1896) American editor and scholar was a professor and lecturer at Harvard from 1881. He published philological treatises and editions of the poets but his great work was *English and Scottish Popular Ballads* (8 vols 1867-9) very considerably extended in later editions.

**Child, Sir John and Sir Josiah** Governors of the East India Company. John Child (d 1690) became chief of the company in Bombay 1689 and later Governor of Bombay. In the struggle with the Moguls he was ousted by Aurangzeb 1689 and made peace. Josiah his brother was actually to the Navy 1650 took shares in the East India Company and advocated the company's political aims in Parliament later becoming chairman of the company. He was so an economist advocating freedom of trade and State regulation of

He was author of *Trade Interest and Discourse on Trade* (1688).

**Childbirth** see PREGNANCY AND BIRTH

**Childbert**, name of three Frankish kings. **CHILDEBERT I** (d 558) son of Clovis governed Paris and NW France extended his dominions into France and invaded Spain. **CHILDEBERT II** (50-595) King of Austrasia allied himself with Guntram of Burgundy and on Guntram's death annexed his kingdom. **CHILDEBERT III** nominal King of France reigned (under Pippin) from 695 to 711.

**Childeric** name of three Frankish kings. (i) **CHILDERIC I** (c 437-481) King of the Franks centred in Tournai fought against the Visigoths Saxons and Alamanni on behalf of Rome. (ii) **CHILDERIC II** (c 653-673) son of Clovis II and king of Austrasia was assassinated by disaffected subjects

from Neustria. (iii) **CHILDERIC III** (d c 55) the last of the Merovingian dynasty a weak ruler was dethroned and succeeded by Pepin.

**Childers Hugh Culling Eardley** (18-1896) British administrator. He was appointed Agent General of Victoria in 1857 and sat as Liberal MP for Pontefract 1860-3 and for St. Edinburgh 1896-9. Childers was First Lord of the Admiralty 1868-71 Secretary for War 1890- during the Egyptian War and Chancellor of the Exchequer 188-5. He effected army reforms supported Irish Home Rule and drafted a report for a commission on Irish finance.

**Childers Robert Erskine** (1870-1909) Irish politician. He served in the South African War and in the Royal Air Force during the World War. On election to the Dail Eireann he became secretary to the Irish delegation to Westminster 1901. He joined with De Valera in opposing the Anglo-Irish Treaty 1921 and took up arms with the Irish Republicans. He was captured court martialled and executed for treason Nov 1922. He was the author of *The Piddle of the Sands* (1903).

**Child Psychology** As with animals the development of children's minds can only be studied by observation of their behaviour and the younger the infant the more rigidly this rule holds. There are 3 approved methods used to this end.

1 *Naturalistic Observations* This method needs no apparatus or special conditions. By it the child is simply watched in its reactions to its environment.

2 *Experimental Observation* This demands that special conditions shall be laid down and the child's reactions observed in relation to them.

3 *Psychometric Observation* By this it is possible to fix standards of behaviour in relation to age level and to note if a child is higher or lower than its mental age.

4 *Clinical psychology* combines the above methods and also makes use of

psycho-analysis (*qv*), thereby revealing that the child has a rich inner life

5 *Co-operative Child Research* is popular in America and to some extent on the Continent of Europe Under its heading are grouped all sciences that affect child life—animal psychology (*qv*) not excluded

Child life begins *before birth* A 2-month-old foetus demonstrates reflex (*qv*) actions At the 3rd month movement begins (quickenings), and increases during the 4th, 5th, and 6th months, till by the 7th month all vital reflexes are fully developed, thus a premature birth brings not a dead but a living creature into the world

Birth itself, be it normal, instrumental, or by section, is a traumatic experience constituting life's first grief Apart from physical pain, that may be experienced owing to flexion and moulding of the head in passing the pelvic ring, the infant has left a comfortable warm state of rest in the amniotic fluid to experience the chills and knocks of the outer world To live it must now breathe for itself, and take nourishment It must be fully realised that whilst a 7-month baby can live, a 9-month baby has already formed *habits*—almost a character After birth the senses which were not required during intra-uterine life must be developed

The first object to attract a child is the human face, which tendency persists, so that in later life the choice of a love object is first a matter of facial beauty Even among people who wear little or no clothes, the face is still regarded as the attractive part of the body Hearing develops rapidly, but seeing is a comparatively slow process, horizontally moving objects attracting the gaze before vertically moving objects can do so The normal child does not reach out "to grasp the moon" or even nearer objects till it is about 6 months old The cry of dissatisfaction with which the new-born infant first tastes the air is soon differentiated and expressed in the difference of tone, hunger, cold, and

discomfort, and not until 3 months have passed does it become sufficiently reconciled to life to express pleasure, and another month must usually pass before it laughs After that the production of sound becomes an attractive pastime, and the infant enjoys himself making a noise, any kind of noise Sound-making develops into words, "mamma" and "dadda," at about 9 months, not because the child wishes to pay compliments to the authors of his being, but because those are the easiest sounds to make By 2 years old he is making remarks with 300 words at his disposal, and 10 times as many at 6 years old

Dr Kohler's apes (*see ANIMAL PSYCHOLOGY and COMPARATIVE PSYCHOLOGY*) showed that they were intelligent beings by pulling a string to secure an object attached thereto These chimpanzees were 3-4 years old, but a human child can perform the same feat even before his first birthday By 2 years old he knows the difference between the cat's being *in* or *under* the oven By 12 years old he knows what it means to have *pity* for the dog and to *envy* his friends the possession of a bicycle The child's inner life as revealed by psycho-analysis is filled with dreams and fancies, many of a sexual nature

Every child is a philosopher, in that he builds up a system including birth and metempsychosis, and sometimes even death and immortality, in its scope, and if the promise of childhood was carried over into adult life, the human race might progress on to the plane of the gods—each man might move his mountain, whether it be of rock or reform

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Children's Courts, or *Juvenile Courts*, were established by the Children Act, 1908, with the object of keeping child offenders, who have probably erred in ignorance or through pressure of circumstances, as free as possible from the

ment of criminal proceedings and the jury that the atmosphere of a court may produce Courts of summary jurisdiction when hearing against youthful offenders sit in a different building or from that in which they ordinarily sit or at different times unless a child is charged jointly with an adult and except in the latter case children while being conveyed to and from court or while waiting in court be prevented from associating with adults Except by special leave of the court the only persons who may be present are the members and officers of the court the parties to the case their legal representatives and other persons directly concerned and press representatives The success or failure of this system depends mainly on the quality of the magistrate presiding and on the supervision exercised by the probation officers to whose care the child may be entrusted

Chile Republic on W coast of S America extending from about the centre to the extreme S The territory is very long and narrow being c 500 m. from N to S but averaging only c 90 m from W to E It is bounded N by Peru S and W by the Pacific Ocean and E by Bolivia and Argentina The coastline is fairly regular in the N but after it reaches Chilbe Island there are a number of indentations and many islands

The surface is clearly marked into three divisions on the E are the Andes in the centre is a very long high valley and on the W are the coast ranges which dip beneath the sea towards the S to form the islands leaving the valley at its widest The Andes rise considerably from S to N and average between 5000 and 20 000 ft in height among the most notable peaks are Aconcagua (28 000 ft) Mercedaria (22 000 ft) and Juncal (19 500 ft) The rivers all flow W to E and none of them is of any great length

The natural regions are divided N to S into three in the N there is the great desert an extraordinarily arid

region but of great importance for its nitrate deposits in the centre the fertile grain and agricultural country and in the S an extremely wet heavily forested region

*Climate* varies considerably owing to the unusual length from N to S in places in the N the temperature rises to 100 F and in others falls as low as 40 it is considerably modified by the cold Humboldt current and on the whole temperatures are lower throughout the year than might be expected

*Flora and fauna* are not particularly interesting among the trees the Algarroba Espina Chilean pine and various conifers may be mentioned and of the animals the puma wild cat and chinchilla are outstanding

*Industry and Agriculture* The occupations of the inhabitants are divided between mining and agriculture of which the former yields the main export wealth of the country The deposits of nitrate of soda are among the most valuable in the world though they have declined somewhat since the World War the yearly average is about £10 millions an important secondary product is iodine next in value is copper worth about £9 millions annually and third comes iron ore Other minerals are gold silver manganese and sulphur

Agriculture is carried on in a manner reminiscent of the feudal system the main products are wheat oats beans and potatoes grapes are very important and there is a flourishing wine industry Dairy farming is of growing importance and large numbers of sheep and horses are raised Industry as a whole is not yet organised on modern lines and most products are for domestic consumption they include leather some textiles soap and chemicals The imports which are usually less in value than the exports are mainly of textiles petroleum manufactured goods sugar tea and coffee

The chief towns of Chile are Santiago the capital (703 000) Valparaíso



(189,000), Concepcion, Antofagasta, and Iquique

*Races, Religion, Education* There are three principal native races, the Fuegians, Araucanians, and Chingos, the Europeans are mainly of Spanish descent, with some Germans and Britons, there is also a large percentage of mixed races. Roman Catholicism is the State religion, though the church has been disestablished. Education has been considerably improved in this century, and more than half the population is literate, elementary education is free and compulsory.

Communications are fairly good a railway runs most of the length of the country. The Trans-Andine Railway provides communication with Argentina. Roads are being metalled, and there is considerable coast sea transport. Telegraphs, postal service, and wireless are all well developed.

Military service is compulsory, the Army having been trained partly by German officers, naval and air services have both been largely directed by British officers.

*Government* The government is republican, and is carried on by a President and a National Congress consisting of a Senate and a Chamber of Deputies. The Senate consists of 45 members, and the Chamber of 132 members, election is by general suffrage of the reasonably literate. For purposes of local government Chile is divided into provinces, in their turn divided into departments, local government officers are responsible to the Central Government.

*History* Chile began as a Spanish colony by conquest in the 16th cent, it proceeded along the ordinary lines of exploitation for profit for nearly two centuries, until the Napoleonic wars in Spain threw it largely upon its own resources, a national assembly was formed, which soon resolved itself into a dictatorship, and in 1810 allegiance to Spain was thrown off. The country soon became divided between allegiance to the old régime and the new. In 1814 war broke out, and the Royal-

ists were victorious. Two years of severe Spanish repression followed, after which war broke out once more; the republican forces were successful, and independence was proclaimed in 1818. During the next 10 years the Spaniards were finally ousted from the country, and Chile, under the naval leadership of Lord Cochrane, assisted Peru in its liberation from Spain. A long period followed in which economic progress was steady, while political progress wavered under a series of Presidents who were intrigued and counter-intrigued into office. The decades after 1860 saw the development of a mere liberal administration, and the only notable event of this period was Chile's part in the war between Spain and Peru (1860).

The growing mineral wealth of the N. regions led to considerable friction with Bolivia, as the boundaries were by no means clearly established. Hostilities began in 1879, Bolivia gaining the support of Peru. After notable Chilean successes the U.S.A. offered to act as mediator, but no satisfactory agreement could be reached. Chile's military successes continued, and by the peace which was finally established she considerably extended her territories.

During the World War Chile remained neutral, and her exports were much affected until the demand for nitrates rapidly began to grow in volume. After the War Chile became a member of the League of Nations. There have been a number of constitutional difficulties since 1920, but the country as a whole continues to make steady social and economic advance. Area, 285,000 sq m, pop 4,300,000.

*Chiltern Hills*, a chalk system extending from S.E. Oxfordshire, through Buckinghamshire, and into Bedfordshire a few m N of Luton. The N.W. slopes are much sharper than those of the S.E., and the general height of the crest line averages between 500 and 800 ft. The highest point is near Wendover (900 ft). The Chilterns are geologically part of the larger chalk

system which includes the Berkshire hills and extends far beyond Hitchin.

**Chiltern Hundreds.** A Member of Parliament cannot resign his seat but may become disqualified by accepting an office of profit under the Crown. A member who wishes to resign generally applies for the stewardship of the Chiltern Hundreds or some other nominal office in the gift of the Chancellor of the Exchequer. The application is never refused. The original function of the steward was to put down robbers in the Chiltern Hill. The nominal salary was formerly £0 a year thus making the stewardship into an office of profit. The office is retained until the appointment is revoked to make way for the appointment of another holder.

**Chimæra, [KIMÆRO]** a (Greek) mythical monster part lion part goat part dragon that breathed fire. It was vanquished by Bellerophon (q.v.).

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**Chimney piece, the framework** of a fireplace. In mediæval times a stone hood was built above the hearth sometimes semi-circular in shape to draw up the smoke. Later this was ornamented and marble pillars and armorial bearings carved in stone were often added. In Renaissance (q.v.) and Baroque (q.v.) architecture chimney pieces were often the focal point in a room. Early chimney pieces were sometimes a recessed and benches placed on each side so that people could sit well out of draughts. In the 19th cent. chimney pieces usually consisted of black or grey marble frames with one shelf and mirrors placed on the wall above. The present tendency is towards the plainest possible fireplaces.

**Chimneys, to Repair** see **REPAIRS**.

**HOUSEHOLD**

**Chimpanzee** an ape which with the gorilla is structurally the most man-

like of all the anthropoids. Both in habit and in the forests of central Africa. The chimpanzee is distinguished by its smaller size, much larger ears, less swollen nostrils, longer upper lip and narrower hands. See **ANTHROPOID APES**.

**China.** The territory of China is the mass of land in the Far and S.E. of Asia including China proper, Tibet, Inner and Outer Mongolia, Sinkiang and Manchuria, but only China proper will be considered here as the other States are virtually separate countries. The boundaries are Inner Mongolia on the N., Tongking, French Indo-China and the S. China Sea on the S., Upper Burma, Tibet and Sinkiang on the W. and the F. China and Yellow Seas on the E. Two large islands may be noted: Hainan (Chinese) off the Liu-chow peninsula on the S. and Formosa (Japanese) off the S.E. coast and numerous smaller islands off the S., S.E. and E. coasts as far as the mouths of the Yangtse-kiang R. The coastline is freely indented and over 1000 m. in length; there are innumerable bays of which the largest include Canton, Hui-tau, Hang-chow, Yangtse-kiang, Kiao-chow, Lai-chow and the gulfs of Peking and Liaotung which form one huge gulf with the strait of Peking between Port Arthur and Wei-hai-wei as its outlet.

**Relief.** The principal mountain system runs W. to E. roughly across the middle of the country extending from the Kuen-lun Mountains of Tibet in a steadily diminishing elevation well into the province of Ifo-nan and including the Tsin-ling-shan and Funiu-shan ranges. In the N.W. there is a system of high tablelands and hills stretching from the Shan-si province through the N. of Chih-li towards Inner Mongolia. The ranges of Shan-tung are a separate isolated system. S. of the Yangtse-kiang valley are a number of ranges most of the S. being hilly except in the Sze-chwan basin in the lower reaches of the Yangtse-kiang river. Among these S. ranges are the Kun-tiao-shan parallel to the Tsin-

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ling-shan, the highlands of the Yu-nan province in the S W, the Nan-shan in N. Kwang-tung, and the Ta-ching-shan on the W borders of Fu-lien

*Rivers* Two are outstanding the Hwang-ho in the N and the Yangtse-kiang in the centre. The Hwang-ho (or Yellow R) rises in the Kwen-lun Mountains, and flows E and then N into Inner Mongolia. There it flows almost due E and then sharply S into China again, along the Shan-si and Shen-si borders, to turn sharply E

waters the richest agricultural areas of China. The Si-kiang in the S is notable for its fertile valley, but is not comparable in length with either of the others.

Of the large system of lakes in the S and E parts of the Yangtse-kiang valley, the most southerly is the Tungting-hu, and others include the Poyang-hu, Tai-hu, and Hung-tze-hu, this last is in the old course of the Hwang-ho R before the channel moved much farther N.

*Climate* The climate of this vast

## CHINESE ART



south of Pu-chow, and proceed E and NE to its mouths in the Gulf of Pechih-li. Its total length is c 2800 m, little of it is navigable, and it tends to overflow its low banks, and alter its course, to the destruction of local property. The Yangtse-kiang, one of the greatest rivers in the world (c 3000 m), also rises in the Kwen-lun Mountains, but to the S of the Hwang-ho. It flows SE, and then branches sharply NE about 100 m N of Yu-nan, to flow E and NE to the E China Sea. It is navigable for nearly 1700 m, and

country naturally varies considerably from N to S and from the coast inland. In the main it is governed by the monsoons, and has a regular wet season between March and April, and in Sept. The summer temperatures are not unduly high, though heat can become intense in the S. The inland regions sometimes suffer serious droughts, as does the NW tableland, and there are occasional violent hurricanes on the coast. The extreme W plateaux and mountains experience extremes of heat and cold.

**Flora and Fauna** Intensive cultivation over many centuries has removed much of the original flora but the bamboo banyan palm paper tree and various coniferous trees still exist. There are some European shrubs including the rhododendron and a great variety of flowers. Of the fauna only the cat bear goat antelope dwarf alligator Chinese tiger and sala trander are peculiar to the country.

**Agriculture** The principal agricultural regions are the N and N W devoted to wheat millet pasturage and dairy farming the Yangtze

from the successful cultivation of the mulberry to feed the silkworms and



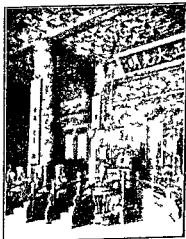
Ch g ase

c 190 000 tons of silk cocoons or roughly a quarter of th worlds raw silk is annually produced Cotton is grown over more than



Chi ese P it ry Lob i f g Dyna ty kiang valley the great rice cotton and tea district the Sze chwan basin with similar products and sugar-cane and the S E valleys another great tea district where two rice crops can also be raised in favourable seasons. The S W is the least developed but there is some pasturage and the opium poppy is cultivated. The total area under cultivation is over 200 000 sq m. Beans are of rapidly increasing importance especially for export. Pigs are raised almost everywhere and in the N dairy farming is steadily increasing.

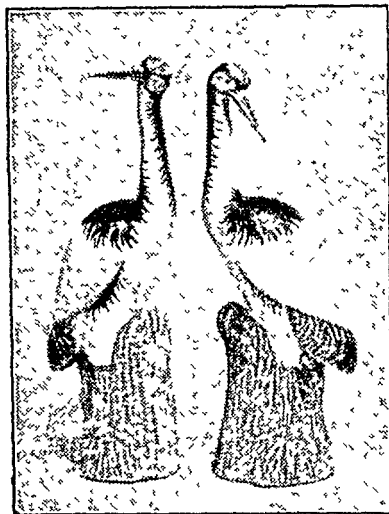
Silk and cotton are commercially very important. Silk thrives especially



P k i g Thro Room.

6 000 000 acres and produces 380 500 tons a year

*Mineral Wealth* has not yet been accurately computed, nor thoroughly worked, but it is known that China has some of the greatest coal-deposits



Chinese pottery Yung Cheng Pair of Cranes

in the world at present there is an annual output of some 30,000,000 tons. Iron is next in importance, and it is estimated that there are several hundred million tons available. There are also smaller, but still notable, quantities of tin, oil, copper, tungsten, bismuth, and salt. Under a settled and progressive Government, manufactures of the first importance may be developed.

*Industry* The most notable modern development is the opening of cotton and woollen mills and silk manufactures. China is beginning to use her raw materials instead of exporting them and buying back the finished product. British and Japanese mills in some of the largest towns also produce cotton yarn and piece goods. Flour-milling is rapidly superseding the older methods, and there are iron-works and glass-factories. Imports, owing to the huge demand for

food and manufactured goods, exceed exports. The principal imports are cotton goods, woollens, metal goods, foodstuffs, tobacco, and chemicals. Exports in order of value are beans, raw silk, coal, raw cotton, hides, leather, and tea.

*Towns* The largest towns are on the coast or in river valleys; they include Nanking, the capital (pop 1,000,000), Shanghai (3,000,000), Canton (860,000), Changsha (1,275,000), Fuchow (1,500,000), Ningpo (2,000,000), Tientsin (900,000), and Peiping; previously Peking (1,400,000).

*Races, Culture, and Religion* The Chinese are classed among the Mongolian races, and are ethnically a very mixed people owing to the absorption of Tartars, Tibetans, Burmese, Manchu, and other races, but their common civilisation has had a very unifying effect. Culture has been unchanged for hundreds of years; the family is the predominant social unit,



Chinese lady

and the fanatical desire for sons largely accounts for the gigantic population. Ancestor-worship is a dominating social factor, and the dead are

hardly less members of the family than the living. Two religions are native to the country—Confucianism and Taoism and Buddhism was introduced in the 1st cent. A.D. Christianity especially Roman Catholicism is tolerated, though it does not make much headway. Chinese art, philosophy and literature are discussed in separate articles.

**Education.** Since the early years of this century and especially since the

and rule have also improved and stimulated public effort and but for the Civil War and the Japanese War would have had an even more marked effect. There have always been plenty of unmade roads and tracks on which oxen and human transport have predominated but metalled roads now cover over 34 000 m. Railway mileage exceeds 13 000 m. Inland water transport on rivers and canals has been very important ever since the



Chinese pottery vases.

proclamation of the Republic in 1911 education has received a great impetus though a huge proportion of the population is still illiterate. There are Government schools, mission schools and universities at Peiping, Wuchang, Nanking, Hangchow, Sianfu, etc. The Hong Kong University, staffed by English professors, attracts students from all over China, and there is a steady increase in the number who go abroad to study Western culture.

**Communications.** The new ideas

construction of the Grand Canal in the 6th century. Possibly the oldest method of transport is the junk traffic on the rivers and coasts which is especially heavy on the Yangtze Kiang. The telegraph and telephone are being developed and the Post Office, now under the Ministry of Communications, serves the whole country.

**Government, Area and Population.** The country is divided into 18 provinces, all nominally under the administration of the



Chi-hi, Shan-tung, Shan-si, Ho-nan, Kiang-su, An-hwei, Kiang-si, Chi-kiang, Lu-kien, Hu-peh, Hu-nan, Shen-si, Kan-su, Sze-chwan, Kwang-tung, Kwang-si, Kwei-chow, and Yun-nan. The total area, of which estimates vary, is about 1,275,000 sq m., the population is approximately 475,000,000.

China was declared a Republic in 1912, and is governed by the Kuomintang or National Party. At the head

Local government is centralized under the control of the National Government, and is administered in each Province by a civil and a military governor, elected or approved by the Executive Yuan. Provinces are subdivided into circuits and districts. All local government officials are responsible to the capital.

**Defence.** Easily the most interesting of the Chinese fortifications is the famous Great Wall. It is more than 1400 m. in length, and extends from the Gulf of Pe-chih-li W. over every natural obstacle to the border of Turkistan. At regular distances watch-towers are placed. It is built of bricks, slate, and earth, is 20 ft. high in most places, though it has now crumbled a good deal towards the W., and its top forms a roadway c. 12 ft. wide. The Army, which was reconstituted after the defeat by Japan in 1895, has gradually become more efficient, but is still so disorganised by the recent civil and Japanese conflicts as to be little better than an ill-armed and largely undisciplined mass. The Navy, which is extremely small, is in even worse plight. Slow improvement is being effected by the British Naval Mission, sent out in 1929, and by the training of young Chinese naval officers in the British Fleet.

**History.** Of the great Chinese dynasties a few were of long duration, many were short and unimportant, and between each there was a period of war, local rule, or civil strife. The first of the great ruling houses was the Chou, which lasted nearly 9 cents until the 3rd cent B.C. During this period the Empire increased greatly in area, and spread from N. China to the Yangtse valley and the E. coast. There was great cultural development, and this period includes (551-479 B.C.) the life of Confucius. The Chou dynasty gradually lost its authority, and the country dissolved into its constituent States, from which the Ch'in, from the warlike N. area, emerged, seizing the central power. For some years they successfully unified the country. The



Chinese pottery Ming vase

is the President, and the Government consists of five Councils (*Yuan*) which are supreme in their own spheres: the Legislative, Executive, Control (or Supervisory), Examination (for public service), and Judicial. Each council is made up of a President and Vice-President, and has between 25 and 100 members according to its importance, appointed by, and responsible to, the Central Committee of the Kuomintang. There is also a Cabinet on the W. model.

subsequent fall of the Ch in resulted in the accession of the Han another warlike house whose military conquests were notable. Their decay and the subsequent loosening of firm discipline were followed by a period of more than 3 cents when the country was divided into several States and Tartar and Tibetan raiders made great encroachments on the W.

The next dynasty of importance was the Sung (10th-13th cents A.D.). This was another great period of scholarship and art and saw notable advances in education. The Sung, near the latter end of its power was considerably shaken by the victories of the Mongol invader Jenghiz Khan whose successor Kublai Khan had a brilliant reign as the most famous member of the Mongol or Yuan dynasty. He it was who received the famous Polo brothers with Marco Polo their nephew Marco served Kublai as general envoy and administrator for a number of years. There followed the Ming rulers whose reign saw a steady increase in western visitors and traders a Portuguese settlement being made at Macao in the middle of the 16th cent. The last dynasty was the Ching or Manchu from about 1660 to 1911.

During this time the steadily increasing pressure of Europeans and Japanese for trading privileges developed in the second half of the 19th cent into an ignoble scramble for Chinese trade. The first clash came when British merchants were refused certain trading privileges the Chinese having at no time looked with favour on foreign trading settlements. The importation of opium became a bone of contention and the Chinese took ruthless measures to suppress it. War broke out (1839) continued sporadically for 3 years and ended with the Treaty of Nanking (1842) whereby the British obtained Hong Kong. Americans and French then pressed for and obtained trading treaties which were satisfactory to neither side and after some years of unrest war broke out again (1856 see CHINA WAR). England and France

uniting. There followed trade and residential privileges in which the Russians and Americans took care to join and peace of a kind was again established. The next trouble was with Japan whose expanding population and trade demanded outlet. After considerable friction war broke out in 1894 over the question of Korea. The Japanese victory was speedy and complete and Formosa was ceded to them. Korea was made independent (1895).

During this period railway and other industrial expansion began in China and numerous concessions were granted by or coerced from the Chinese. Meanwhile the Manchu rulers were growing weaker and the first seeds of nationalism and republicanism were being sown. In 1900 the Boxer rising against foreigners was vigorously suppressed and considerable indemnities in privileges and kind exacted. Out of this arose the disorders in Manchuria which gave Russia the excuse to transfer troops there and in the end precipitated the Russo Japanese War giving Japan still further power in the Far East. In 1905 the Dowager Empress began to make efforts to improve Chinese conditions a plan of educational reform was introduced and a legislative assembly suggested and actually formed after her death. By 1910 when this assembly met, the opposing forces of westernisation and of nationalism were being felt throughout the country. In the next two years the Manchus who had formed a semi military garrison for centuries were attacked and overcome and the child Emperor deposed. The royal armies had been led by Yuan Shih kai and with the armistice a Republic was declared (1912). Yuan Shih kai was made President a diplomatic stroke that restored peace and a degree of unity for the next four years.

The outbreak of the World War enabled Japan supported by the Anglo-Japanese alliance to seize the German settlements in Shan tung and to take over all German trade conces-

sions Later, China declared war on Germany, and thus secured a seat at the Peace Conference, where she vigorously pressed for the restoration of territories and districts which had been ceded in the past few decades. The Conference, however, decided that the question was not within its scope, and Japan kept the Shan-tung territories, all other German extra-territorial rights were cancelled.

The Washington Conference saw China's next effort to rid herself of foreign interference. The Powers expressed sympathy, and undertook to withdraw armed forces as soon as the security of their nationals was assured, and Japan yielded most of her possessions in Shan-tung.

Chinese domestic history since the World War has been most difficult to follow. the military leaders have warred amongst themselves, separate Governments have been set up in the N and S, and politicians have followed each other in and out of power in bewildering succession. In 1920 Wu P'ei-fu, Ts'ao Kun, and Chang Tso-lin, the Manchurian general, united against Tuan Chi-jui, and drove him from power, in 1922, however, Wu and Chang Tso-Lin made war on each other, and Chang was driven back into Manchuria. In 1924 the war was renewed and Wu defeated. During this period there had been a separate government in the S under Sun Yat-sen, who, in 1925, when temporary peace was restored, went N to join in the political deliberations, but died soon after his arrival in Peking. The next year saw another union between Wu and Chang against Feng Yushiang, the "Christian" general, who was defeated and forced to retire into Mongolia.

In 1926 Sun Yat-sen's National Government (the Kuomintang) attacked the military leaders with the Nationalist Army under Marshal Chiang K'ai-shek. The movement was a popular one, and Sun Yat-sen was pronounced a national hero and benefactor. The Nationalist armies were

everywhere successful, but at the moment of this triumph the Kuomintang was split by anti-Communist clamour, the Communists, led by Borodin and other Russians, having found a place in the Nationalist Party. The N armies united under Chang Tso-lin and an *impasse* seemed to be reached. The party, however, becoming more moderate, was reunited again by 1928. Further military success followed, and Chang Tso-lin was killed. The capital was moved to Nanking, and though there were still considerable dissensions, the Kuomintang took over the reins of government. In 1931-2 an autonomous state of Manchukuo was set up under Japanese protection. See MANCHURIA.

China, a fine variety of pottery, so called because it was first introduced from China. Egg-shell porcelain is almost transparent. See also CERAMICS.

Chi-nan (Tsinan), Chinese city, capital of Shan-tung, lying within a few miles of the Hwang-ho R. It is an important manufacturing and trading city, and has a large foreign commercial settlement. The use of the Grand Canal (see CHINA) made the town important in early centuries. There is a Christian University. Pop 300,000.

China Rhubarb, *Rheum officinale*, has large, coarse, rough-textured leaves resembling rhubarb, and a great inflorescence some 10 ft high which looks like a giant sorrel. The plant has valuable astringent properties.

China Sea. The sea along the E. coasts of French Indo-China and China. Divided into the S China Sea and the E China Sea by the Formosa Strait, the E includes the Yellow Sea, and passes through the Strait of Korea into the Sea of Japan. Farther E, beyond the Philippines and Japan, the sea becomes the N Pacific. The whole area is subject to typhoons, and is a good deal shallower than the Pacific.

China War (1856-9) between China and England and France, broke out over two incidents in 1856. the

seizure by the Chinese of the Chinese crew of a British ship *Arrow* and the murder of a French missionary. The forts guarding Tientsin were captured and to save Peking the Chinese granted certain concessions. These included customs privileges, additional Treaty Ports (*q. v.*) and diplomatic representation at Peking etc. The Chinese did not carry out all these concessions and the French and British were driven back in attempting to penetrate beyond the Taku forts. The war was renewed and in 1860 Peking was captured. The Chinese agreed to the concessions and paid an additional indemnity.

**China Wood Oil**, an alternative name for tung oil (*q. v.*)

**Chinchilla**, a S. American rodent (*q. v.*) belonging to the porcupine tribe and equalling a small rabbit in size. It lives in burrows and rock-crannies in the high Andes of Chile and Bolivia.



Chinchilla.

and has longish ears and a bushy tail. Owing to its peculiarly soft texture and beautiful silvery grey hue the fur of the chinchilla is greatly prized and the animal is now comparatively scarce.

**Chinese Language**. If only because Chinese is spoken by a greater proportion of the human race than any other

tongue it must be considered as one of the most important of all languages. The languages spoken within the political and geographical areas known as China are many and one may differ from another as greatly as French from Italian, but they are all so intimately connected by the official written language that they may be considered as one Chinese language. A definite distinction however should be made between the spoken and the written languages for these have developed independently.

The spoken or colloquial language comprises many dialects including the following: Cantonese, Hakka, Swatow, Foochow, Wen how, Ningpo and Hankow. But the most important of them all is the Mandarin and specifically the Pekingese dialect of Mandarin which may be taken as a type of all the Chinese dialects. The salient characteristic of spoken Chinese is that each individual word is a monosyllable and that the number of speech sounds is remarkably small; these two facts account for much of the linguistic peculiarity of Chinese. For with so few sounds to express the whole range of concepts it follows that one sound must be made capable of carrying a number of meanings. There are several ways of effecting this, one being the pairing of two words together to form one concept (so departing from the strictly monosyllabic character of the language) so that the meaning of the second is limited by that of the first. Another expedient is the use of classifiers. A snake for example is long and thin, therefore the word for any long and thin object is preceded by the classificatory word for *snake*. Thus a pencil is called a *snake pencil* and in the familiar *one piece man piece* is merely an anglicised form of the Chinese classifier which governs the word *man*. But the chief means of distinguishing from each other words identical in their combination of speech-sounds is the use of various tones or musical pitches. The same combination of vowels and

may, for example, mean either *marriage* or *separation* according to the tone or pitch of the voice with which they are pronounced

The script of the written language originated, like all writing, in the pictorial representation of objects; but Chinese is the only language in which some of the original pictographs survive with their primary meaning. These have been developed so that by the aid of various devices, they are capable, as probably no alphabetic system would be capable, of representing the language in writing. There is no such thing as a Chinese alphabet. A page of written or printed Chinese consists of a number of independent units or characters, each of which could be contained in a square of uniform size, and which are read from top to bottom, starting from the right. It is broadly true to say that grammar, as it is understood in the Indo-European and Semitic languages, for example, does not exist in Chinese. Grammatical and syntactical relations, however, are determined by certain established rules of word order and sentence arrangement. It has been said that the written language is distinct from the spoken languages, and it is necessary to indicate at least one of the reasons for this distinction. A spoken syllable may, as has been pointed out, be capable of bearing a number of meanings, each of which has to be differentiated by some means, but in the written language this is not necessary, since each meaning can have a separate character assigned to it. This alone was enough to cause in the course of time a wide divergence between colloquial and written Chinese.

**Chinese Literature** The earliest Chinese poetry is represented by a number of ballads, some as old as the 9th cent. B.C., which are collected and known as the *Odes of Confucius*. The 8th cent. A.D. produced the two greatest Chinese poets, Li Po and Tu Fu (qq v). The Sung Dynasty (A.D. 960-1260) reflected in its poetry a reaction against the care-free gaiety of the previous

(T'ang) dynasty, and the best known of its poets is Su Tung-p'o (1031-1101). During the succeeding centuries Chinese poetry increased in volume, but, while maintaining an astonishingly high level, did not reach the heights of the T'ang period. Joy in nature and a love for humanity are its dominant notes. Recently there has been some breaking away from the old conventions and an influx of W influences, a combination of tendencies which must have a profound and interesting effect upon Chinese poetry.

The Chinese are famed for their thoroughness and dryness of their histories, and one of the greatest of these, the *Shih Chi* of Ssu-ma Ch'ien, appeared in the 1st cent. B.C. The *T'ung Chien* ("mirror of history") of Ssu-ma Kuang, later revised by Chu Hsi in the 12th cent., is but one of many more. A large proportion of the literature is directly concerned with the philosophy and teaching of Confucius and Lao Tse (qq v). In the 13th and 14th cents during the Mongol dynasty, the drama had a very active life, and to the same period belongs one of the earliest romances, the *San Kuo Chih*. Another great novel, written in the 17th cent., is the anonymous *Hung Lou Meng*.

The long history and the great mass of Chinese literature have together brought about the necessity for a large number of encyclopædias and dictionaries, and such compilations have been made from the very earliest of times. Printing, in some form, was almost certainly known to the Chinese at least as early as the 8th cent. A.D.

The Chinese version of the Buddhist scriptures, the Tripitaka, is of great importance to students of Buddhism.

At the present day, owing to closer contact with W influence, there is an enormous output of literature, out of which it is as yet not possible to distinguish the lasting from the ephemeral.

Reference may be made to *A History of Chinese Literature*, by Prof. H. A. Giles (1901).

**Chinese Painting.** Of the exquisite

paintings which represent for us the work of the greatest Chinese artists only a very few remain to-day. But from those few from copies of old works and from written accounts of the early artists' achievements we know that Chinese painting was a subtle and skilful medium of expression long before even Giotto who was the first great European painter arose to found the Western tradition of painting. Chinese painting is essentially a thing of understatement and suggestion expressed by means of a sensitive and eloquent line the chief media being ink applied with a brush to silk. Colour when used is usually water-colour.

For subject matter many of the finest Chinese painters devoted themselves to depicting nature notably landscapes which notwithstanding the deliberate use of simplification and convention were invested with reality and as in some of the finest paintings of the Sung period an intense spirituality. But centuries before the Sung dynasty Chinese painting had reached a high stage of excellence as is proved by the scroll painting in the British Museum *The Admonitions of the Instructress* which is the work of a 4th-cent artist. The same museum also houses some rare and precious relics of the great Tang period (7th-10th cents) when Buddha was the inspiration of the greatest artists. To this period belongs Wu Tao-tzŭ the most illustrious figure in Chinese art. The finest landscape painters arose during the Sung dynasty one of whose emperors Hui Tsung was a painter and patron of painting. Two schools of painters represent this period—those of the north and those of the south. The landscapes of the northern painters have a certain austerity and depict nature in a less smiling mood than the more poetic and delicate works of the southern painters. But the paintings of both schools are equally contemplative and in them the trivial of nature a phenomenon clothed with symbolic and poetic

significance. It is an impressive fact that at a time when Western art was fast bound within the limits of Byzantine formalism the Chinese painters had evolved a form of philosophic and poetic expression technically remarkable and decoratively exquisite.

None of the artists of the later dynasties surpassed the great landscape painters of the Sung period. In the Ming paintings there is greater preoccupation with decorative detail and a corresponding absence of that lyricism which is typical of the earlier paintings while the more modern artists have for the most part restricted their work to various employments of the conventions perfected by the old masters.

**Chinese Philosophy** *see* **BUDDHISM**  
**CONFUCIANISM** **TAOISM**

**Chinese Porcelain**, *see* **CERAMICS**

**Chinese Wax** (insect wax Chinese tree wax) is the secretion of an insect which is deposited on the branches of certain trees found in China and other parts of the Far East. The wax is obtained by boiling the branches. It is a pale material of melting point about 80 C. It is used in China for candle making and is exported for the manufacture of polishes etc. Its chief constituent is ceryl cerotate which is the cerotic acid ester of ceryl alcohol.

**Chingleput**, district of British India surrounding the city of Madras. The surface is flat and the soil generally infertile. Crops are unimportant but there are industries of cotton and silk tanning and quarrying. The coastline is c. 100 m long and provides fishing and salt making. Area 2800 sq m. pop. (1911) 1500000. The town of Chingleput is c. 40 m from Madras. Of interest are the ruins of Fort St George taken from the French by Clive (1759) and of considerable strategic value in the Indian Mutiny. There are pottery manufactures and a large rice trade. Pop. 11800.

**Chinon**, historic

Indre-et-Loire

Vienne the d

of England

own in the

in the R.

Henry II

are the

ruined castle, the Château de Milieu, the Grand Loge visited by Joan of Arc, and the Tour du Moulin (10th cent) Pop 5750

**Chinook**, see RED INDIANS, WINDS

**Chintz**, printed calico with a calendered finish, used for upholstery and hangings. It is a development from a material called *chint*, originally imported from India.

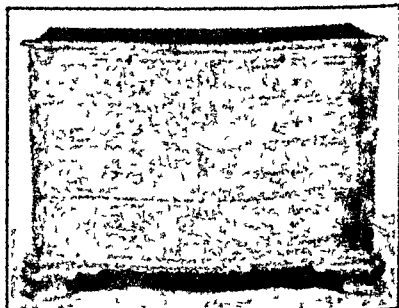
**Chinwangtao**, Chinese treaty port opposite the Liao-Tung peninsula. Chiefly notable for the export of coal and kindred products from the Kaiping mines, it is one of the few ports in these latitudes that is ice-free in winter. It acts as port to Tientsin. Pop 20,000.

**Chios** (*Ki'os*) [*ké'-os*], Greek island off the Anatolian coast, S of Lesbos. It is hilly and fertile, the chief products being fruit, figs, wine, mastic, antimony, and marble. Chios contains some interesting Greek remains. Area, c 350 sq m, pop 76,000 (estimated).

**Chipmunk**, a small striped ground-squirrel found in Central Asia and N America.

**Chippendale, Thomas** (c 1717-70), English cabinet-maker and furniture designer. There were actually three

hant period in the history of this art in England is named after him. His father's workshop is known to have been at Worcester in the early years of



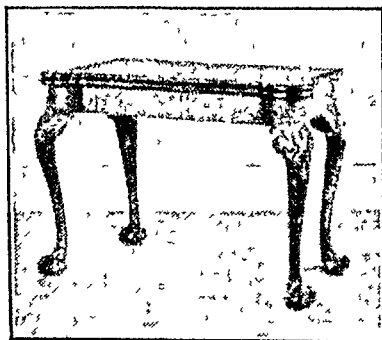
Chippendale Mahogany Commode

the 18th cent. Father and son had established their London workshop by 1737, and here the son carried on the manufacture of much of the best furniture ever produced in England. The name "Chippendale" has come to be applied to the period of Thomas Chippendale rather than to his actual handiwork, and very few pieces can be proved to have originated in his workshops. The term is also loosely applied to modern reproduction furniture, made in the style.

Chippendale's chairs probably show him at his best as a designer; they are of many varying types, some comparatively plain, others of the well-known ribbon pattern, some with elaborate "Gothic" tracery, and others Chinese in their inspiration. His fertile invention produced tables, cabinets, settees, bookcases, and specimens of almost every article of furniture in use at the time. His *Gentleman and Cabinet-Maker's Director* (2nd ed, 1762) contains 200 plates. His son, the third Thomas Chippendale, succeeded to the business, which he carried on until his death in 1823; he was also a painter, exhibiting several works in the Royal Academy.

**Chippewa**, see RED INDIANS

**Chiquitos**, see RED INDIANS



Chippendale Mahogany Card Table

generations of cabinet-makers of this name, but it was the second Chippendale who became so famous as a designer that the most bril-

**Chiroi, Sir Valentine (1852-1929)** British journalist and author was foreign editor of *The Times* from 1899 to 1912. His best works are *Fifty Years in a Changing World* (1917) and *With Pen and Brush in Eastern Lands* (1919).

**Chiroptera, see BATS**

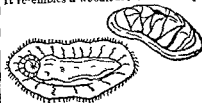
**Chisel**, one of the oldest of hand tools consisting of a straight bar with a cutting edge at one end. The cold chisel is made from round or hexagon steel hardened and highly tempered. It is used for cutting metal, stone, etc. being driven by a hammer. Carpenter's chisels are of many different shapes and sizes; they are mostly rectangular in section with wooden handles and are used either under hand pressure or driven by a wooden mallet.

**Chita**, district and town of the Far Eastern Area, USSR. Most of it is an infertile plateau with small crops of rye, oats and potatoes. The mineral wealth is very considerable and includes coal, iron, gold, tin and bismuth. Timber and furs are also valuable. The industries are iron founding, leather work and chemicals and there is considerable general trade. Area c. 70,700 sq. m. pop. (1916) 379,000. The town has grown to considerable importance since the opening of the trans-Siberian railway. Pop. 57,700.

**Chiton** [from *kliton*] (1) The loose tunic which was the usual garment worn in varying forms by the ancient Greeks of both sexes; numerous representations of which appear in sculpture and on vases.

(2) The most primitive of existing Mollusca (gastropods) so-called from its coat of mail consisting of 8 overlapping shells on the back. It is most nearly related to the Gastropods in having a creeping foot and well-developed head, but is distinguished by its segmented shell and in being bilaterally symmetrical in all its organs. Chitons are found in all seas even to a depth of over 9,000 fathoms but more usually in shallow water. A small species about

1 in long is common on British coasts amongst seaweed on which it feeds. It resembles a woodlouse and curls up



Chiton

when touched. Some tropical species may be 6 in long.

**Chitral**, native Indian State and town under British influence. It is situated S. of the Hindu Kush and is a part of the NW Frontier Province. Its importance is strategic and the natives, mainly Khos and Ronas, are well disposed towards the British. From March 4 to April 20, 1899, the British and Sikhs were besieged in the town by a partly Afghan force. Area 4,400 sq. m. pop. State 36,000. Town (1916) 10,000.

**Chittagong**, Indian district and town of E. Bengal between the Chun Hills and the Bay of Bengal; the hills include the sacred Sataland. The soil is fairly fertile and the crops include tea, jute and rice. The town of Chittagong is an important commercial centre and the terminus of the Assam-Bengal railway. Exports are tea from local districts and Assam oil from Burma, rice, jute, etc. Area, 2,500 sq. m. pop. district 1,612,000. town 36,000.

**Chittoor**, Indian district and town of Madras Presidency. The surface is mainly formed by the W. slopes of the E. Ghats. The hills have valuable and undeveloped deposits of iron and copper. The soil is fairly fertile and produces millet and rice. Area 5,600 sq. m. pop. district c. 1,300,000. town c. 18,000.

**Chivalry**, originally meaning the body of knight-hood. The word has come to denote those customs and manners which tradition ascribes to



knights, that is, the code which is an amalgamation of the ferocity of the barbarian chieftain and the civilising influence of the Christian Church. It has particular reference to the worshipful and protective attitude of the male towards the female. The word in English law meant also the tenure by which the knight held his land.

**Chladni, Ernst Florens Friedrich** (1756-1827), German physicist, famous for his experiments in sound. The shapes formed by dust on vibrating plates are known as "Chladni's Figures". He journeyed through Europe lecturing and performing on the euphonium, which he invented, and published several scientific works.

**Chloral** [*pron* KLO'RŪL], trichloroacetaldehyde,  $\text{CCl}_3\text{CHO}$ , is an oily liquid with a sharp smell. It has a boiling-point of  $98^\circ\text{C}$  and melts at  $-57^\circ\text{C}$ . It is used to a considerable extent in medicine as a soporific in the form of *chloral hydrate* ("Knockout drops"),  $\text{CCl}_3\text{CHO} \cdot \text{H}_2\text{O}$ , which is obtained as a solid crystalline substance of melting-point  $52^\circ\text{C}$  on adding about one-fifth of its bulk of water to chloral. Chloral hydrate is applied externally as an anodyne. Chloral is manufactured by passing chlorine into absolute ethyl alcohol.

**Chloramines**, see ANTISEPTICS

**Chloretone** [*pron* KLO'RITŌN] (*chlorbutyl-alcohol, chlorbutol*) is a white crystalline substance melting at  $81^\circ\text{C}$ , with the formula  $\text{CCl}_3(\text{CH}_2)_2\text{COH}$ . It is manufactured by the condensation of acetone and chloroform (*qqv*), in the presence of potassium hydroxide. Chloretone is employed in medicine to relieve whooping-cough, and is also used with success to allay sea-sickness. Externally it has a local anæsthetic action, and is used in the form of an ointment for the treatment of piles.

**Chlorine**. For the characteristics of chlorine see the article CLEMENTS

Chlorine is a gaseous non-metallic element never found in the free state, since chemically it is one of the most reactive substances known. In com-

bination it is very widely distributed, both in inorganic and organic materials, it is essential to life. The most common commodity in which it is present is probably sea-water, which contains numerous chlorides in solution, the principal of which is sodium chloride (common salt). The gas is yellow-green in colour, and its name is derived from a Greek word signifying this fact. Chlorine is used for a number of purposes in industry, and there are several methods for its manufacture. Deacon's process yields chlorine that is diluted with air, and is usable only for bleaching, either directly as such, or else by conversion into bleaching powder (*qv*).

Pure chlorine is now usually manufactured almost exclusively by the electrolysis of solutions of sodium chloride, it is marketed in the liquid form, stored in steel cylinders, whence it escapes as a gas on releasing the pressure.

One of the principal uses of chlorine is as a sterilising and disinfecting agent, *cg* in the cases of drinking water and swimming-baths.

As a bleaching agent it is chiefly used for the decolorising of cellulose substances, such as wood pulp and artificial silk.

The chief compounds of chlorine are dealt with under the headings of their basic radicals. See also HYDROCHLORIC ACID, BLEACHING

**Chloroform**, trichloromethane,  $\text{CHCl}_3$ , is a colourless liquid with a characteristic smell, a boiling point of  $61^\circ\text{C}$ , and a melting-point of  $-63^\circ\text{C}$ . It was one of the first substances to be used in modern surgery as an anæsthetic, and is still employed to some extent for this purpose, although owing to its high toxicity as compared to other anæsthetics now available its use is becoming less common. Chloroform is also used as an external liniment and as a local anæsthetic in cases of tooth-ache.

Chloroform is usually manufactured by the action of bleaching powder on alcohol or acetone, and is purified by

distillation. In chloroform intended for use as an anæsthetic it is usual to add about 1 per cent of absolute alcohol since this has a preservative action and inhibits the formation of phosgene (carbonyl chloride) a highly toxic substance which is otherwise liable to be formed. Chloroform is non inflammable and on this account finds some use as a solvent.

**Chlorophyll** [*pron* KLO ROFIL] one of the plant colouring matters that has been found in the chloroplasts (see BOTANY) of all plants that have been examined. These chloroplasts have been found to contain four pigment as follows

**Chlorophyll A** an amorphous blue black substance giving green blue solutions and having the probable formula  $C_{55}H_{72}O_5N_4Mg$

**Chlorophyll B** an amorphous green black substance giving green solutions and having the probable formula  $C_{55}H_{70}O_5N_4Mg$

**Carotene (q.v.)** an orange-red crystalline material of formula  $C_{40}H_{56}$

**Xanthophyll (q.v.)** a yellow crystalline material of formula  $C_{40}H_{58}O_2$

The very interesting feature about the chlorophylls is that they contain in combination a metallic element magnesium which is present to the extent of 2.1 per cent. Chlorophyll A is found in fresh leaves in amounts of about 0.2 per cent and chlorophyll B in amounts of 0.075 per cent. They are best obtained by the extraction of leaves with ether. The two modifications of chlorophyll A and B can be separated from one another by their unequal distribution between methyl alcohol and petroleum ether. Chlorophyll is of enormous biological importance to the plant since its function is to catalyse the photochemical reactions by which the plant is enabled to grow and to synthesise carbohydrates from carbon dioxide and water.

Chemically it is of interest to note that chlorophyll has a considerable similarity in structure to hæmoglobin (q.v.) the pigment and oxygen-carrier of mammalian blood. Hæmoglobin con-

tains iron as its inorganic constituent and both it and chlorophyll can be degraded to the same product ætioporphyrin.

Chlorophyll is used commercially to some extent for the colouring of food stuffs and beverages. See also BIO-CHEMISTRY.

**Chloropicrin**, an organic liquid with an unpleasant odour and a boiling point of  $11^\circ C$ . Its formula is  $CCl_3 \cdot NO_2$ , and it is more correctly known as nitro-trichloromethane or trichloro-nitro methane. It is manufactured by the action of chlorine or bleaching powder on picric acid (q.v.) and being highly poisonous is used as an insecticide. For this purpose it is mixed with an equal amount of carbon tetrachloride and used in the form of a spray. Chloropicrin in addition to being toxic is also a powerful lachrymatory and was used as a poison gas in the war of 1914-18.

**Chloroplast**, see CPILL.

**Chlorosis**, a type of anaemia almost exclusive to adolescent girls and readily curable by the administration of iron. The condition is brought on by an unhealthy diet, long working hours and irregular action of the bowels. The disease owes its name to the peculiar greenish transparent and wax like condition of the skin. Sufferers show as a rule no tendency to wasting or emaciation; they are on the other hand rather plump. They become easily breathless and are troubled with severe headaches and not uncommonly subject to noises in the ears.

**Choate, Joseph Hodges (1832-1911)** American diplomat. He practised as a barrister in New York and was Ambassador to Great Britain from 1899 to 1903. He represented the United States at The Hague Peace Congress in 1907. He was very popular as an after-dinner speaker.

**Chocolate** is a food prepared from the cacao bean sweetened with sugar and variously flavoured. It contains some theobromine, a stimulating substance and a little fat, starch, mineral

matter, proteins, and tannin. A sustaining drink can be made as follows

1½ oz chocolate powder

½ gill water

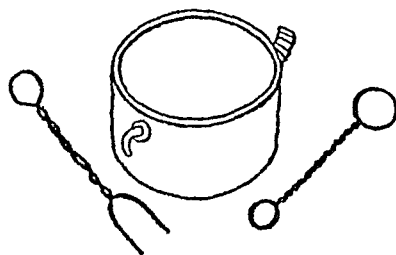
1 pint milk

1-2 oz sugar

A pinch of salt (if desired)

Melt grated chocolate in water over gentle heat. Add sugar, salt, and scalded milk. Beat thoroughly with a whisk. Serve with whipped cream.

Chocolate is the basis of an enormous variety of sweets. Many of these can, with care and patience, be made at home, but it is more convenient to buy the commercially-made article



dipping pan and forks

Chocolate-making Implements

**Chocolate Manufacture**, see COCOA.

**Choctaws**, see RED INDIANS

**Chodowiecki, Daniel Nicolas** (1726-1801), a Polish miniaturist and engraver, was born at Danzig and in 1743 went to Berlin, where the remainder of his life was spent. Working as a clerk, he produced miniatures in his spare time, until his series illustrating the *Life of Christ* won such popularity that he was able to devote himself entirely to his art. His engravings for Goethe's *Hermann und Dorothea* and Lessing's *Minna von Barnhelm* are among his best work.

**Choir** [kwɪr], a body of singers of various voices. The usual choir has two groups of female voices, soprano and alto, and two groups of male voices, tenor and bass. A choir may, however, be composed of either male or female voices alone, or, as in

many Church choirs, of boy sopranos and male altos, tenors, and basses. The earliest plainsong music and the wonderful compositions of the Flemish contrapuntists were written for choirs. Handel used the choir for his most stupendous dramatic effects, and such modern composers as Holst, Elgar, and Mahler have written part of their finest music for this medium. England has for long enjoyed a reputation for fine choral singing, and "choral societies" are possibly more numerous in Great Britain than in any other country. The best-known British bodies are the Glasgow Orpheus Choir, whose virtuosity and finish are remarkable, the Bach Choir, the Oriana Choir, the Royal Choral Society, which gives its performances at the Albert Hall, and the Leeds Choir. Famous foreign choirs which have visited this country include the Don Cossacks (Russian male voices), the Dayton (Ohio) Choir, and the Sistine Chapel Choir (boys and men) from the Vatican.

**Choiseul, Etienne François, Duc de** (1719-1785), French statesman. He served as soldier in the War of the Austrian Succession, gained Mme de Pompadour's favour, and was appointed Ambassador to Rome. He confirmed the Franco-Austrian alliance, and was Foreign Minister during the Seven Years' War. By the "Family Compact" he gained the support of the Spanish Bourbons, reformed the Army, and annexed Corsica and Lorraine to France. His enmity towards the Jesuits led to his downfall. The Choiseul family has had other distinguished members in its long career.

**Choke Damp**, see COAL-MINING

**Cholera**, a disease that does not now appear in Grt Britain, as the natural outcome of improvement in water supply and better conditions of sanitation. It still occurs, however, in parts of India, and it occasionally spreads W., along the Trade routes.

The disease is caused by a micro-organism known as the comma bacillus,

which can remain alive in water for several weeks but is rapidly killed by drying. The germ is spread by contamination of water and food by the excreta either of infected people or of persons known as carriers who having recovered from the disease still harbour the germs. The carrier state is not so common a sequel in this disease as in some others notably typhoid. Nevertheless great care has to be taken at sea ports to prevent the entrance of the disease into the country and a constant watch has to be kept on our water supplies to ensure that they do not become contaminated from unexpected sources.

The disease itself begins within 10 days after infection the first symptoms being violent vomiting and diarrhoea with cramps in the muscles. These attacks are followed by a stage of collapse and exhaustion the patient assuming a corpse like appearance and having a cold skin and weak pulse.

The death rate is as high as 50 per cent but if the patient survives he enters into a third stage of the disease during which there is a prolonged convalescence.

Cholon [HO LOU] commercial centre of French Indo China situated in the south of the province of Cochinchina near Saigon. There is a large trade in rice and smaller industries including glass making copper founding and boat building. Cholon was founded by the Chinese in the 18th century and they still form about a quarter of the population. The French have been responsible for the building of schools hospitals and municipal buildings. Pop 12000.

Cholula, historic Mexican town 40 km from the city of Puebla, which is now largely replaced by a commercial centre. Cholula was one of the great centres of Quetzalcoatl worship and on the summit of its gigantic pyramid was one of the gods' most famous temples. Cortés sacked the city and massacred many of the in-

habitants in the early 16th century. Pop c 6500.

Chondriosome see CELL.

Chopin, Frédéric François (1810-1849) Polish composer and pianist the most famous of all composers for the pianoforte. Chopin was the first to reveal the possibilities of the piano as a lyrical and vocal instrument. Compared with that of Beethoven his genius was slender and limited but it was genius. Some of the moods he evoked so exquisitely and perfectly in his lovely melodies would no doubt have been beneath Beethoven's Olympian notice. But to the fact that Chopin's music reveals him to have been essentially a human being with the romantic bias of his time much of the appeal of his music is due. Born near Warsaw.

he made his first appearance at a public concert at the age of 9. He published his first composition 5 years later while still a student at the Warsaw Conservatoire. By the time he was 20 he was making



Frédéric Chopin.

very successful appearances throughout Germany and Austria as a concert pianist and 4 years later after the defeat of Poland by Russia (a source of grief to Chopin who was an ardent patriot and expressed his passionate resentment at this time in his *Nocturnes* and *Etudes*) he took up his residence in Paris. His brilliant but refined and expressive playing quickly won him a reputation as a virtuoso and he resumed his tours appearing for the first time in England in 1837.

His physical and emotional troubles began to develop at this time for the symptoms of his tubercular disease became more marked as his unhappy infatuation for George Sand grew more intense. The liaison was broken

by a painful quarrel and two years later he died. He was buried in Paris, in Père-la-Chaise.

His works include 27 Études, 52 Mazurkas, 25 Preludes, 13 Valses, 19 Nocturnes, 4 Ballades, 4 Scherzos, 7 Polonaises, 3 Sonatas, 3 Impromptus, etc., all for pianoforte, and 2 Concertos for piano and orchestra.

**Chopsticks**, implements used by Chinese for conveying food to the mouth. They look like tapering pencils, and are made of wood, bone, or ivory.

**Chorale**, hymn tune of the type introduced by Martin Luther and his fellow Protestants at the time of the Reformation to replace the old Church music. One of the best known is Luther's own *Ein' feste Burg ist unser Gott*. Some of the most beautiful chorales were written by Bach.

**Choral Singing**, singing by choirs (*qv*) in oratorio, part song, or ecclesiastical music in churches. Open-air choral singing has been stimulated in recent years by community singing campaigns. Choral singing is to be heard at its best in the N. of England and in Wales.

**Chordata**, an important phylum of the animal kingdom, so named from the presence, at least at some stage of life, of a dorsal elastic chord, the notochord, which is the foundation of the vertebral column of vertebrate animals. Two additional characters also distinguish the Chordata: the pharynx opens to the exterior by slits either in embryonic life or permanently, and the central nervous system arises on the dorsal side of the body as an infolding of the ectoderm. The Chordata include the Vertebrata (*qv*), the Lancelet (*qv*), which used to be regarded as a fish, the Sea Squirts (*qi*), and some other marine animals formerly classified as "invertebrates."

**Chorea**, term applied to almost any nervous disease in which involuntary muscular movements occur. Common chorea (Chorea minor: Sydenham's chorea, St. Vitus' Dance) is of subacute onset and occurs chiefly in

children between the ages of 5 and 15, the proportion being 3 girl sufferers to 1 boy. Trauma, or shock, is the usual cause of an attack, but it is aggravated by a pre-history of rheumatism. The ailment very seldom terminates fatally, its normal course being a gradual increase in co-ordination with consequent control of the muscle groups involved. The onset of the first attack at, or soon after puberty, is much more serious than during childhood, because the heart may become affected, whilst an attack during pregnancy results in abortion with 25 per cent loss of life. Medical aid should always be sought in cases of even slight attacks during childhood. The patient should never be frightened or threatened, and must not be allowed to become excessively fatigued. Absolute quiet and rest are indispensable conditions for recovery.

**Choriambus** [*pron* KORIÁMBUS], the name given in Greek prosody to the foot consisting of two short syllables between two long ones, - ∪ ∪ - (e.g. "down to the sea").

**Chorus**. This term, the modern connotation of which requires no definition, has a special application to the ancient Greek drama. The chorus was originally a band of worshippers gathered together to sing hymns to Dionysus (Bacchus). Subsequently the poet Arion gave artistic form to their hymns, and later a leader was chosen from them to tell the adventures of Dionysus. With the answering of their leader or *coryphæus* by a second member of the chorus, there grew up the beginnings of dramatic dialogue and action. Thus, with the evolution of the fully developed Greek drama, the chorus remained as an integral part of the drama. Its function was to sing the lyric odes between the acts, together with rhythmic movements or dances, and occasionally to take part in the dialogue through their spokesman the *coryphæus*. The odes were often explanatory of the preceding or subsequent action of the drama, and thus

fact explains for instance why Shakespeare makes Ophelia tell Hamlet that he is as good as a chorus

**Chose in Action**, in law the right to a thing as distinct from the thing itself. The term includes copyrights patents and all rights arising out of contract e.g. debts. At common law rights of action were not assignable. The rule established to discourage litigation was abolished in 1873 except with regard to a few cases such as pensions

**Chosroes I and II**, Kings of Persia. **CHOSROES I** (531-579) invaded Syria and Mesopotamia signing peace with Justinian in 562. He extended the Persian empire carried out internal reform and gave toleration to the Christians. **CHOSROES II** (590-628) made peace with the L. Empire in 591 and later captured Jerusalem and tried away the Holy Cross. Heraclius finally overthrew him in 628 and the disintegration of the Persian empire began.

**Chota Nagpur** large district of Bihar and Orissa (British India) comprising several British and Native divisions. Chota Nagpur is rich both in agriculture and minerals producing a large percentage of the total coal output of India. Crops include Indian corn rice potatoes and some tea. Large portions of the region are forested. The natives are mainly Hindus education is not highly advanced. The territory was separated with Bihar and Orissa from Bengal in 1912. The chief towns are Ranchi Jamshedpur and Singhbhum. Area 27 000 sq m. Pop. 3 000 000.

**Chouans**, Breton rebels who joined the Royalist rising of La Vendée (q.v.). They fought a guerrilla war against the Republican troops but were gradually worn down and were dispersed by 1793.

**Chough**, a comparatively small slender billed bird of the crow family with black plumage and red legs and bill. Formerly it nested in tolerable abundance on precipitous cliffs of the coasts of S. England and hence is often

called the Cornish chough. It is now very rare having been driven away apparently by jackdaws which occupy similar nesting sites.

**Chow or Chow Chow** is a Chinese breed of dog of the Eskimo type (q.v.) with pricked ears a tightly coiled tail and thick coat. It is usually black or reddish brown in colour. Chows are courageous and splendid fighters and as house dogs can hardly be surpassed. See **ESKIMO DOG**.

**Chrétien de Troyes** French poet of the 12th cent. whose best known poems are *Erec Yvain the Conte del Graal* and *Perceval*—all concerned with King Arthur and the Knights of the Round Table. Versions of them exist in English (of Yvain) Old Norse and Welsh.

**Chrism** a compound of oil and balsam sometimes with other spices used in the Eastern Orthodox and Roman Catholic Churches for the anointing of priests and bishops at ordination and in certain other ceremonies such as the blessing of the baptismal font on Easter and Whitsun Eves and confirmation (q.v.).

**Christadelphians**, a Christian sect founded in the U.S.A. 1848 by John Thomas (d. 1871). They claim to be the only true representatives of the Apostles of Christ and believe in the approach of the second coming of Christ to found an earthly kingdom for his saints.

**Christchurch** (1) small Hampshire town a few m. E by N of Bournemouth and 61 m from the coast. The chief centre of interest is the 11th-cent. church and the ruins of the Norman House and castle may also be mentioned. A number of valuable prehistoric finds have been made in the neighbourhood. The town is of very early foundation but has now declined in importance except as a small agricultural and holiday centre. Pop. (1931) 9000. (2) Large city of New Zealand situated on Pegasus Bay just N of the Banks Peninsula. The capital of Canterbury province. It lies

in a rich agricultural district. Local industries are meat packing, woollens, and those arising out of agriculture. The city is well laid out, and has handsome parks, and public buildings, including the cathedral, Canterbury College, and the Government buildings. It was founded c 1850. Pop (1932) 129,000.

**Christian**, name of several Kings of Denmark.

**CHRISTIAN I** (1448-81), King of Denmark, Norway and Sweden, founded the University of Copenhagen (1478).

**CHRISTIAN II** (1481-1550) succeeded his father, John, as King of Denmark and Norway in 1513. Aided by Archbishop Trolle, of Sweden, he invaded Sweden, defeating Governor Sture in 1520, and after the battle of Uppsala was proclaimed King of Sweden. Christian later incurred the hostility of his Danish nobles by his favouring of the middle classes, and by his reform of the laws on Dutch models. Gustavus Vasa of Sweden revolted against him and was proclaimed King in 1523, and when Frederick of Holstein seized the Danish throne, Christian fled. He returned to Denmark in 1531, was captured and died in prison.

**CHRISTIAN III** (1502-1559), son of Frederick I, King of Denmark and Norway, was a convert to Lutheranism, and was strongly opposed by the Catholics on his father's death in 1533. On his accession in 1534, he established the Lutheran Church in Denmark, and the Crown was made hereditary in his line. He was an ally of the German Evangelical princes, and an enemy of Emperor Charles V, but after the Peace of Spire in 1544 he avoided international complications, devoting himself to the rehabilitation of Denmark.

**CHRISTIAN IV** (1577-1648), who succeeded his father, Frederick II, in 1588, improved the Danish Army and Navy, and in the war with Sweden gained ascendancy over Gustavus Adolphus. He acquired control over Bremen, Werden, and Holstein in 1621. His difficulties in the war with the

Emperor and the League led him to a Protestant alliance with Gustavus Adolphus. Sweden declared war on him after Gustavus's death in 1643, and Torstensson invaded Jutland, but Christian blockaded the Swedish fleet at Kiel Bay. Christian's fleet was later wiped out by the Swedish and Dutch, and peace was signed in 1645. During Christian's reign the Danish settlement of Tranquebar, in the E. Indies was founded.

**CHRISTIAN V** (1646-70-99), a weak and obstinate ruler, failed to take advantage of the wealth of middle-class ability that was the outcome of the revolution of 1660. He engaged in a fruitless war with Sweden from 1675 to 1679.

**CHRISTIAN VII** (1749-66-1808), corrupt and semi-imbecile, left the government of Denmark to his favourite, Struensee. His queen, Caroline, died in exile (1775).

**CHRISTIAN VIII** (1786-1848), crowned King in 1830, regained Norway's allegiance to Denmark as Stadtholder in 1813, but was forced by the Allied Powers to cede Norway to Sweden in the following year after his defeat by the Swedish Crown Prince, Bernadotte.

**CHRISTIAN IX** (1818-1906), succeeded Frederick VII in 1863 following the London protocol of 1852. He was also ruler of Iceland. War with Austria and Prussia led to the loss of Slesvig and Holstein in 1864. Though an opponent of the Radical Party, Christian was compelled to assent to the formation of a Leftist Cabinet in 1901.

**CHRISTIAN X** (b 1870), succeeded Frederick VIII in 1912. He preserved his alliance with Norway and Sweden during the World War. He extended the franchise to women in 1915. Created King of Iceland in 1919. During his reign Denmark regained Slesvig.

**Christian Brothers**, association founded in 1684 by St John Baptist de la Salle, and made a religious congregation by Pope Benedict XIII, 1726, with the object of promoting education.

Christian principles. The Association claims to have been the first to initiate Sunday Schools. There is a similar but separate religious order in Ireland known as the *Irish Christian Brethren*.

**Christian Endeavour Societies** were formed originally in the U.S.A. in 1881 and soon afterwards elsewhere for the promotion of the spiritual welfare of young people. An international and interdenominational union was formed in 1893.

**Christiania**, see OSLO

**Christianity** the religion of the followers of Jesus Christ which includes a great number of widely diversified sects. Apart from survivals of ancient Churches in the Near East—the Church of Abyssinia for example—and certain modern sects mainly originating in America there are three main branches of the Christian religion—the Eastern Orthodox, the Catholic and the Protestant, the latter being split into a number of denominations disagreeing chiefly on minor points. In spite of the great differences of creed between these three branches (for which see EASTERN ORTHODOX CHURCH, PROTESTANTISM, ROMAN CATHOLIC CHURCH) they hold in common certain doctrines which may be considered as the general substratum of the Christian faith, modified by the interpretations of the individual churches.

Adherents to Christianity claim it to be a religion for all men without distinction and despite its division into sects Christians with some reservations on grounds of expediency have held fast to its universality. It is preeminently an ethical religion stressing the need for individual righteousness as much as specific ritual acts. It is a religion created wholly and fully not the slow development of the religious ideas of a people as was the Hebrew religion. This is not to deny the influence of the Hebrew religion firstly on Christ and secondly on the early Christians nor to belittle the later but equally powerful influence of

Greek philosophy but to stress that were it not for the life and teaching of Jesus Christ there would have been no Christianity.

Christian doctrine may be briefly summarised under two heads: teaching about God and teaching about Salvation. These two doctrines closely related under the influence of Greek philosophy and comprising within them many other doctrines are generally accepted by most of those who call themselves Christians.

Christ's teaching about God was influenced by the Hebrew religion in which He was brought up but He viewed this teaching from a new angle. Hebrew religion is dominated by the concept of the unity of God. The Old Testament shows the gradual development of the idea. At first the Hebrew God was a tribal deity one among many and powerless outside the tribal territory. Out of this primitive religion with a God powerful and avenging but limited to the tribe developed a concept which evolved under the influence of the prophetic teachings. Gradually the idea of a God appeasable by burnt offerings and other rites gave way to the idea of a God who demands goodness on the part of the individual. Love (Isa. lviii 3-10) justice and mercy (Mic vi 6-8) became necessary for the service of God rather than ceremonial. The tribal deity thus became a Universal God judging the whole earth the one and only God (Amos vi 14).

The monotheistic religion with its insistence that the will of God can be followed only by leading a life of righteousness has influenced the Christian conception of God in several ways firstly through the insistence on a life of devotion and piety in the service of God secondly through the Christian teaching as to the character of God a God of love but a just God and thirdly in the metaphysical concept of the Trinity which reconciled Hebrew monotheism with the divinity of Christ and the Holy Spirit.



The idea of pleasing and serving God by a righteous life was emphasised by Christ and by Christians. Christ taught not only that God required obedience and goodness from His people, but also that He was a loving God. His law, the law of the Hebrew religion, was not made to be kept rigidly at all costs, but was made for human beings. "The Sabbath was made for man, not man for the Sabbath."

The doctrine that God is Love is found in the Hebrew prophets, but Christ expanded it and made it the centre of His teaching. God is love and God is merciful, therefore a way is open to the faithful, however sinful, to salvation through repentance. According to the teaching of Christ, God is a loving God, desiring that mankind also should love not only their neighbours but their enemies. God is a merciful God, forgiving sinners when they truly repent, and He is one God, all-powerful and universal, who will weed out the tares from the wheat and the wicked from the godly. The Crucifixion and Resurrection of Jesus Christ involved important additions to the theory of divinity. Christ Himself is worshipped as the Saviour, as God incarnate in man and suffering for the sins of the world, so that God might be propitiated and mankind obtain salvation.

This question of the divinity of Christ and of the Holy Spirit was disputed in the early Church, many varieties of heresies were crushed at Councils before the prevailing doctrine was thrashed out. Monotheism was preserved by the doctrine of the Trinity—three persons in one God, the Father, the Son, and the Holy Ghost. This metaphysical doctrine shows clearly the influence of Greek thought. The nature of God the Son (that is, Christ) occasioned other disputes. Some held that in Him there were two persons; some laid stress on the human Christ, others on the divine. Finally the accepted doctrine asserted a dual nature but single personality

of Christ both God and man. The Christian doctrine of God received its formulation in the Early Church. God was a Trinity consisting of Father, Son, and Holy Ghost, He was a loving God desiring the salvation of His people and asking from them righteousness and repentance for their sins. Owing to the Fall of Man this could only occur through the redemption of the sin of mankind. This, according to the doctrine of the Atonement, was brought about by God the Son becoming incarnate and suffering death upon the cross. This doctrine of Atonement is the link between the Christian teaching about God and about Man's salvation.

The Christian teaching about Salvation has two sides, a human and a divine. The divine side is linked through the doctrine of Atonement to the Christian teaching about God, who by sacrificing His only son, Jesus Christ, on the cross made possible the redemption of man and the salvation of all. On the human side Christianity continued and developed the emphasis laid by the Jews on personal righteousness as being what God desired of mankind. Salvation is to be acquired through Christ by those who seek forgiveness for their sins. All who would seek salvation must try to obey the ethical code of Christianity, laying stress on love and self-sacrifice. They must have faith in Christ's power to save. Protestants and Catholics dispute over certain points in the Christian doctrine of salvation: whether justification is by faith alone, as Protestants assert, or by works in addition, as Catholics maintain. The idea of salvation developed during the period of the Early Church. With the spread of Christianity to the Gentiles and the Christianisation of the Roman Empire, the dream of an earthly Jewish Christian kingdom following the second coming of Christ gave way to the belief in personal survival after death in the Kingdom of God in Heaven.

These are the essential doctrines of Christianity. Everyone, by living a life of righteousness, by obtaining for-

givenness for his sins through the atonement of Jesus Christ on the cross may obtain salvation. For God one God and yet a Trinity of persons is so loving that desiring man's salvation. He gave him the means to obtain it by the sacrifice of His Son Jesus Christ.

This bare outline is accepted by all Churches but is expanded and developed along different lines by the various sects who may disagree only in quite minor matters of Church rule and discipline. Other divisions particularly the schisms occurring in the early Church and at the Reformation concern vital points of interpretation. The Reformers led by Luther for instance held that justification could be only by faith whereas the Catholic Church insisted on the necessity of the sacraments in addition.

Arising among the Jewish followers of Jesus in Palestine Christianity spread over Europe and the New World and has gained a fair number of converts in Asia and Africa. It has been one of the major historical factors of the last 2000 years. Many of the ideas lying behind the changes in the social structure during the last twenty centuries can be traced to the influence of Christianity. It was the Christian idea of the equality of man before God that led to the anti-slavery movement even though the idea developed through the anti-Christian thinkers of the French Revolution. Many of the ideas held by those who rebuke Christianity for its excessive devotion to the preservation of existing institutions may be traced rather to the Sermon on the Mount than to their own ethical discoveries.

Christian Science religion founded by Mary Baker Eddy (q.v.) in 1866. She taught that God was infinite and one. Every thing He created is good and matter with its consequent evil and sickness is not real being the result of human illusion. Mind alone is real. She taught that Christ showed the Way in the New Testament but that all later doctrines are false. Christian Science is better known for

its practical deductions than for its theory. Mind only being real sickness and suffering can be cured by faith healing. This healing is not confined to what is popularly called physical illness. The World Depression of 1933 could in theory equally well be cured by Christian Science. The cult is widespread in the U.S.A. where its followers have formed themselves into the Church of Christ Scientist with headquarters at Boston Mass. it has an increasing number of adherents also in Great Britain and throughout Europe.

Christian Socialism, a doctrine aiming at a combination of Christianity teaching with Socialism led by Charles Kingsley F.D. Maurice and others after the failure of Chartism in 1848. The Christian Socialists advocated co-operation and small independent workshops and communities. Although the movement died away its influence gave impetus to subsequent organisations such as the Guild of St. Matthew (1877) the Church Socialist League and various social reform movements within the body of the Church.

Christian Social political parties have been formed in Germany Austria Hungary and Czechoslovakia. Most important is that in Austria which is Conservative Roman Catholic and anti-Communist and is drawn from both property-owning classes and peasants. The Christian Social Economic Party in Hungary has similar tendencies being Catholic anti-Semitic anti-Communist and pro-Habsburg. It favours social reform and economic organisation and finds its strength in the city middle-classes with the support of some of the aristocracy and peasants. In Germany the Christian Social Party was a Conservative Protestant and middle-class organisation, first represented in the Reichstag in 1930 and was officially dissolved after the advent to power of the National Socialists in April 1933. It gained only 4 seats in the election of 1933. See also SOCIALISM.

Christianssand, Norwegian port and

fishing centre situated in the extreme S, on the Skager Rack. The harbour is well equipped, and used by a large number of vessels annually, it is strongly fortified. Industries include ship-building, saw-milling, and engineering. Pop (1931) 19,000.

**Christiansund**, Norwegian port built on several small islands, which enclose its harbour, situated on the W coast due W of Trondhjem. Local manufactures and exports include butter, wood, and fish. Pop (1930) 14,000.

**Christie's**, a celebrated auction-room in London where works of art, jewellery, plate, and other artistic valuables are put up for sale. The business was founded by James Christie the elder (1730-1803) in 1776 at premises in Pall Mall, in which the Royal Academy also exhibited. His son, James Christie the younger, carried on the business, which he moved to its present offices at 8 King Street, St James's Square, in 1824.

**Christina**, (1626-1689) Queen of Sweden, daughter of Gustavus II Adolphus, crowned 1644. A proud and reckless ruler, Christina's opposition to her Chancellor's policy lessened Sweden's gains from the Thirty Years' War. A patron of learning, she founded a national school of literature. Abdicated, 1654, in favour of her cousin, Charles Gustavus. She went to Rome disguised as a man (1655). Spent her remaining years in travel, dying in poverty in Rome.

**Christina**, Maria (1858-1929), Queen-Regent of Spain (1885-1902). Daughter of the Archduke Charles Ferdinand of Austria, she married Alfonso XII of Spain (1879), and became regent for his son on his death (1885), showing wisdom and tolerance as ruler. Her son succeeded as ruler in his own name as Alfonso XIII in 1902.

**Christmas**. The festival of the birth of Christ. Originally the 6th or 10th of January, it was first changed to the 25th December in A.D. 551 at Rome.

**Christmas Island**, British island, incorporated in the Straits Settlements in 1900. It is situated in the Indian

Ocean due S of the N. end of Java. It is important for the large deposits of phosphate of lime, which are worked by a British company, whose employees form the entire pop of the island, c. 1000. Area, 62 sq m.

**Christmas Pudding**: *A typical recipe*

- 1½ lb currants
- 1½ lb sultanas
- 1 lb raisins
- 1½ lb suet
- 1 lb breadcrumbs
- 2 lb moist sugar
- 1 lb peel (mixed)
- 1 nutmeg (grated)
- 1 apple
- ½ pint milk (or stout)
- ½ gill brandy (unless stout is used)
- 2 teaspoonfuls mixed spice
- ½ lb almonds
- 12 eggs
- 1 teaspoonful salt

Prepare all dry ingredients. Make a well in centre, add beaten eggs, milk and brandy, or stout. Stir thoroughly. Put in greased basins, and boil for 7-8 hours. Remove cloth. Cover again with dry cloth, and store for future use.

**Christmas Rose** (*Helleborus*), belongs to the family Ranunculaceae. Hardy perennials, evergreen, and deciduous varieties, with shrubby or herbaceous habit, handsome divided leaves, and large single or clustered white, green, and purple flowers. The many species now in cultivation have been brought from E. Europe from time to time.

**Christopher**, St (fl. c. 250), the patron saint of travellers. Said to have devoted himself, after his conversion to Christianity, to carrying passengers over a ford. According to tradition he was martyred in the persecution of Decius, the Roman Emperor; he became the object of special devotion in the Middle Ages. Feast, July 25.

**Christ's Hospital**, or the Blue Coat School, founded by Edward VI (1553) on the site of the Grey Friars monastery, Newgate Street. In 1902 the school for boys was moved to Horsham, the girls' school is at Hertford. The boys

still wear a semi mediæval costume consisting of a long blue coat knee breeches and yellow stockings with no hat Charles Lamb Coleridge and Leigh Hunt were pupils

**Chromatic Scale**, a scale which progresses by semitones (see MUSICAL TERMS)

**Chromatin**, see CELL

**Chrome-ironstone** see CHROMITE

**Chromic Acid**, the name usually applied to chromium trioxide  $\text{CrO}_3$  though this is not the acid itself but only its anhydride It is used as an oxidising agent See also CHROMIUM

**Chromite** the commonest chromium ore also known as *chrome ironstone* It occurs in the United States India and New Caledonia as well as in other parts of the globe The chemical composition of the ore is that of a mixed oxide of chromium and iron  $\text{FeCr}_2\text{O}_4$

**Chromium**. For the characteristics of chromium see the article ELEMENTS

Chromium is a metallic element that does not occur in the native state its principal ore is *chromite* (*qv*) where it is associated with iron It also occurs as lead chromate in the mineral *crocoite* Most chromium comes from Rhodesia U.S.A. New Caledonia and Asia Minor The method by which metallic chromium is manufactured is the reduction of ferrous chromite (*chrome ironstone*) in the electric furnace with carbon the product thus obtained an alloy of chromium and iron is *ferrochrome* which contains about 70 per cent of chromium and is employed in the manufacture of chrome steels Pure chromium is obtained by the reduction of the oxide with carbon or with aluminium powder (thermite process)

Metallic chromium is used to a very large extent for the manufacture of various alloys both ferrous and non ferrous Stainless steel is one of the most important ferrous chromium alloys containing about 1 per cent of chromium chromium is also a constituent of high-speed steels which have the property of retaining the hardness at red heat One of the chief

non ferrous alloys of chromium is *nichrome* which is composed of 80 per cent nickel and 20 per cent chromium it has a high electrical resistance and melting point and is used in the manufacture of electrical heating units

Chromium has also come into use during the last few years as a medium for the protection of other metals from corrosion and also as a decorative finish being applied by electro deposition The electro-plating is carried out from baths containing an aqueous solution of chromic acid ( $\text{CrO}_3$ ) (See also ELECTRO PLATING)

Chromium is not usually deposited directly on to ferrous materials these are usually first coated with copper then with nickel and the chromium coat is then applied

**Chromium Colours** The compounds of chromium are all coloured and it is to this fact that the element owes its name (from the Greek) The chief uses of chromium compounds are as pigments for which purpose the principal are *chrome yellow* which is usually neutral lead chromate—the chromates of barium and zinc are also sometimes used—*chrome green* which is chromic oxide and *chrome red* which is the basic lead chromate

Several chromium salts such as the acetate are employed in the textile industry as mordants and some of the oxygenated derivatives such as chromic acid and potassium dichromate are used in the manufacture of organic chemicals in the rôle of oxidising agents

**Chromium plating** see ELECTRO-PLATING AND ELECTRO TYPING

**Chromium Steel**, see IRON AND STEEL

**Chromosphere**, see SUN

**Chronicle** the title given to many mediæval histories notably to the Old Russ an *Chronicle of Nestor* and the Anglo Saxon *Chronicle* The *Chronicle Histories* were a species of English plays dealing with historical events without too close an attention to the old monkish chronicles on which they were based Examples are *Troublesome Reigns of King J*

the *Tragical History of King Lear*, the sources of Shakespeare's *King John* and *King Lear*, and, in fact, the historical plays of Shakespeare himself

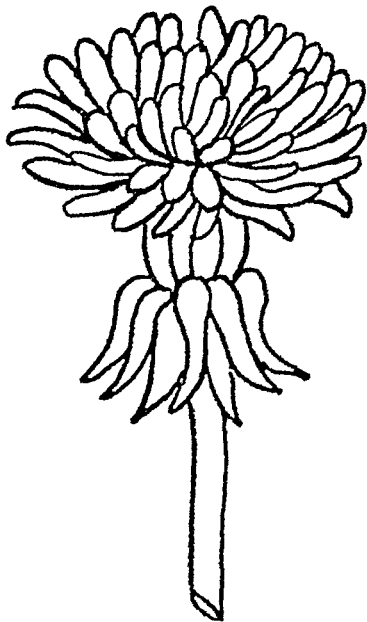
**Chronicles, Books of**, two historical books of the Old Testament, recapitulating the history contained in the books Genesis to 2 Kings, from a different standpoint, and largely ignoring the N Kingdom of Israel

**Chronograph**, an apparatus by which the time of occurrence of events is recorded. In its commonest form the chronograph consists of a tape of paper moved at a uniform speed by means of a motor, usually clockwork or electric. Two pens, usually of fine glass capillary tube, trace lines on the paper. An electro-magnet is connected to each pen so that when it receives a current it slightly deflects the pen. One electro-magnet receives a momentary current at intervals from a standard time-keeper, frequently a pendulum which makes contact every second or more frequently, the other electro-magnet receives a current impulse when the event which it is required to time takes place, for example, the start or end of a race. For very short intervals of time, a drum covered with paper may be used, the marking device being moved by means of a screw thread as the drum rotates, so as to mark two spiral lines upon the drum. The drum is covered with paper smoked in the flame of a candle, and one of the marking points consists of a bristle cemented to the arm of a tuning fork, whereby a wavy line is traced on the paper to serve as a time scale, while another bristle, or sometimes an electric spark, is used to mark the event. Still more rapid measurements require the use of photography, a drum driven at a rapid rate, and travelling at the same time, being covered with a sheet of sensitive paper. By special electrical methods, depending on the rate of discharge of a condenser, or the distance travelled by a ray of light from an electric spark, extremely short intervals of time can be

measured, the first method has been used to measure millionths of a second with accuracy, and the latter thousand millionths

**Chrysalis**, the pupa or resting stage in the development of a butterfly or moth, during which the insect changes from the caterpillar into the adult winged form. The term is sometimes extended to include the corresponding stage in the metamorphosis of other insects, such as flies

**Chrysanthemum**, a favourite garden plant, genus of the family *Compositæ*;



Chrysanthemum.

it has many cultivated varieties. The shrubby perennials of cottage gardens, with numerous small brown, yellow, and rose flowers, have been replaced by handsome plants with only a few stems and a few large leaves, and striking large flowers of many colours. A number of annual chrysanthemums make beautiful displays

in a border and the tiny flowered varieties with flower heads  $\frac{1}{2}$  in across are delightful as edgings in shrubberies. Culture from seed is gradually replacing the methods of cuttings and root division.

**Chryselephantine** term used to describe statues made in Greece of gold and ivory. The statue of Athena in the Parthenon was a triumph of this art. The word is derived from the Greek names for the constituent materials.

**Chrysolite** *see* SERPENTINE

**Chrysopolis (Sculari)** Battle of (Sept 18 393) the Romans under Constantine the Great gained a decisive victory over Licinius Emperor of the East, thus reuniting the Roman Empire under one head.

**Chrysoprase** *see* CHALCEDONY

**Chrysostom, St John** (c 345-40) the greatest of the Eastern Christian Fathers became a Christian in A.D. 370 after a training in Greek philosophy. He lived as a hermit for some years before his ordination as deacon in 381. As Patriarch of Constantinople (398-404) he became famed as a preacher attacking the vices of the Imperial Court. His enemies conspired to depose him at a synod and he was exiled. The anger of the people of Constantinople at this act on led to his recall and he continued to agitate against the Empress Eudoxia. He was again exiled in spite of the plea made by Pope Innocent I and the Emperor of the Western Empire Honorius for his return. His teaching emphasised a stern morality and the need for knowledge of the scriptures. Many of his writings are preserved and are valuable sources of history as well as theology.

**Chub** a freshwater fish of the carp family found in Europe and Central Asia and closely related to the minnow dace and roach. The Golden Oriole a handsome aquarium fish belongs to this division of the carp family.

**Chuck**, a device for holding the work in a turning lathe (qv)

**Chulalongkorn I** (1853-1910) King of Siam. Crowned in 1868 he abolished slavery extended education transport and communication services built hospitals and reorganised the national defences. He visited Europe in 1897.

**Chumbri Valley** important Himalayan valley and valuable line of communication between Tibet and British India. It lies between Sikkim and Bhutan. The British Mission under Sir F. Younghusband took this road into Tibet in 1904.

**Chung king** important city of the Szechwan province of China is situated on the upper reaches of the Yangtse kang R. and is a large treaty port and commercial centre. Most of the exports of Szechwan E. Tibet and neighbouring provinces pass through the town and include tea silk wool skins rice beans and sugar. There is an enormous junk traffic which is steadily increasing as the Red Basin becomes more and more exploited. A railway has been projected to Chengtu the regional capital of Chung king. Pop (1931) 635 000.

**Church**, a word derived from the Greek meaning the Lord's House which refers alike to the buildings used by certain bodies of Christians for worship to the whole body of baptised Christians or to Christian communities sharing tenets in common.

**Church and State** It is difficult to understand the relation of the Church of England to the State without knowing something of its history. In the Middle Ages the Church was largely independent of the State and although in civil and to a certain extent in criminal matters the clergy were subject to the law of the land yet in ecclesiastical matters the canon law administered by ecclesiastical courts governed and the Pope was supreme. There were many clashes between Church and State even before the Reformation which revolutionised the relations between the two and established the doctrine of the absolute sovereignty of the State a doctrine

upon which the seal was set by the Act of Supremacy, 1558, whereby the Sovereign became the Supreme Head on Earth of the Church of England. His powers are now, of course, exercised on the advice of his Ministers; they include the right to appoint archbishops, bishops, and certain other dignitaries of the Church, and to convoke, prorogue, or dissolve the two Houses of Convocation (*q v*).

Not only were the relations between Church and State reconstituted, but also the system of doctrine and worship. An Act of Parliament adopted in 1571 the *Articles of Religion*, otherwise known as the *Thirty-nine Articles*, which, though framed much earlier, had received their present form in 1562. The *Form of Church Services*, or *Book of Common Prayer*, first framed under Edward VI, was, after many modifications, adopted in its present form by the Act of Uniformity (1662). To deny the King's supremacy, to refuse assent to the Thirty-nine Articles or the Book of Common Prayer, is a ground for depriving a clergyman of his benefice. The Church of England has been known since the time of Elizabeth as the "Church of England as by law established," and the sum total of the relations between Church and State is called the Establishment. Failure to conform to the doctrines of the Established Church formerly entailed many civil disabilities. But these have now been swept away, and the State, though closely linked with the Church of England, yet recognises liberty of conscience and protects other forms of worship and other religious bodies.

**Church Army**, founded in 1882 by Wilson Carlile, a Church of England clergyman, later Prebendary of St Paul's Cathedral. It is a Church of England organisation similar to the Salvation Army (*q v*), its officials devote their lives to social service.

**Church Assembly**, legislative body of the Church of England set up by the Enabling Act in 1919. It consists of three houses: (1) bishops, (2) clergy

elected from each diocese; and (3) laity elected by the Diocesan Conferences (*q v*). It may discuss almost any question, and can pass measures which become law after the adoption of the required resolutions through both Houses of Parliament, and the grant of the royal assent. It may not, however, encroach on the Powers of Convocation (*q v*), or make statements concerning Church doctrine.

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**Church of England**, see ENGLAND, CHURCH OF.

**Church History**. The history of the Christian Church can be divided into three broad periods—Early, Mediæval and Post-Reformation. During the first period the main characteristics of the Mediæval Church emerged, its universality, its episcopal and sacerdotal character, the divergence between the Eastern and Western Churches, and the main lines of mediæval Christian doctrine. At first the early Church consisted of Jews marked off from other Jews only by their belief in Christ as the Messiah and their expectation of His speedy return to found a Messianic kingdom upon earth. But with the spread of their teaching to the Gentiles, and especially with the missionary effort of St Paul, the idea of a Church universal and of a Christ, the Son of God, both human and divine and the Saviour of the world, was developed.

Out of the heresies of the early Church emerged the main dogmas of the Church, challenged but rarely before the days of the Reformation.

Apart from those doctrines accepted by the whole body of Christians the most important were belief in the necessity of the sacraments and in the authority of the Holy Church as the living representative of Christ in interpreting the Scriptures and defining doctrine. The main lines of Church organisation that were to endure throughout almost the whole Church until the Reformation and until to-day in the greater part of the Church were then laid down. From being at first a small community of saints stressing personal holiness rather than priestly office the Church became divided into laymen and clergy in holy or minor orders. At first each congregation had a bishop but later bishops had the charge of a diocese and priests looked after the smaller units the congregations. Finally the period is marked by the Great Schism between the Churches in the East and in the West the latter acknowledging the supremacy of the See of Rome.

With the Middle Ages the history of the Church branches in two directions the Eastern Church developing by itself practically uninfluenced by and not influencing the West. In the East the main feature of this period which begins with the foundation of the Byzantine Empire and ends with the capture of Constantinople by the Turks in 1453 was the power wielded by the State over the Church. This accounts for the latter's theological stagnation which would otherwise have been surprising as many of the theologians and controversialists (both orthodox and heretic) of the earlier period came from the East. The Orthodox Church came to stress the preservation of its dogma and the importance of personal often mystical religious experience. In the West the two main features were the development of theology reaching its peak in the Schoolmen such as Aquinas (q.v.) and the rise and fall of the Papacy as a temporal power.

The dry logic of late scholasticism into which the theology of men

like St Thomas Aquinas and Duns Scotus degenerated gave the impetus to a reaction which developed into the theology of the Reformation as well as into the secular thought of the Renaissance. The striving for power by successive Popes brought the Papacy into conflict with the Empire (see HOLY ROMAN EMPIRE and PAPACY).

The Reformation in itself a political as well as a religious movement split the Western Church. After the re-affirmation of the Mediaeval Church doctrines by the Council of Trent the Papacy devoted itself more to ecclesiastical and less to political matters. The period was one of spiritual revival followed in the 18th cent. by a relapse and in the 19th cent. by a fresh revival though in face of the serious challenge of 19th-cent. science. The Roman Catholic Church and the numerous Protestant Churches shared more or less equally in these cycles of religious activity. Generally the features of importance in this period were the missionary activities of the Churches in Asia Africa the Americas the revival in Protestantism of speculative theology and its rejection of many doctrines of the Mediaeval Church. More recently may be seen a reversion to Medievalism in the Catholic revival and the rise of Modernism in Protestant circles. See also ROMAN CATHOLIC CHURCH, ENGLAND, CHURCH OF EASTERN ORTHODOX CHURCH, BAPTISTS, METHODISTS etc.

**Church Rate** tax levied for the benefit of parish churches of England and Ireland and abolished in 1868 after an agitation against it.

**Church Reform League**, an association advocating certain reforms in the Church of England chiefly (1) freedom for the Church in ecclesiastical matters (2) that the laity should have financial control and a voice in appointing clergymen (3) that the sale of benefices should be illegal. By the Enabling Act of 1919 certain of their recommendations were adopted.



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**Chuvashia**, autonomous republic of the USSR immediately W of the Tartar republic, capital Cheboksary. Much of the surface is forested and the remainder has comparatively poor soil which produces oats and rye. Sawmilling is a big industry. There are large flocks of poultry and cattle, pigs and sheep, though of poor quality, are exported widely. Distilling and flourmilling are small industries. The inhabitants, mainly Chuvash, are backward. Area 5930 sq. m. pop. 894,500.

**Cibber Colley** (1671-1757) English actor and playwright. His best play was *The Careless Husband* (1704) but he is remembered mainly for his famous *Apology for the Life of Colley Cibber* (1740)—a work that is our main source of information concerning the theatre at this time. Cibber was not popular with the writers of his day. Jeremy Collier, Johnson and Wieling attacked him, and Pope made him the hero of the *Dunciad*. He was made Poet Laureate in 1730 but his occasional odes are very poor poetry.

**Ciborium** [sibor'ium] cup-shaped vessel used in Roman Catholic churches to contain the Host (q.v.) consecrated for the people's communion and to reserve the Blessed Sacrament in the tabernacle (q.v.).

**Cicada** [s' on sikar' da] an insect (q.v.) of the group *Homoptera* with a big head and large membranous wings. It is notorious for the deafening sound it emits by the males, the sounding

organs consisting of a pair of shell-like drums situated at the base of the abdomen and operated by special muscles.

Cicadas are found in the warmer parts of the world, one of the best known being a N. American species called the 17-year locust because of its appearance in vast numbers at intervals of about that period. The explanation of this is that the larva takes from 13 to 17 years to reach maturity. The female cicadas lay their eggs in the branches of trees and the young on hatching fall to the ground, bury themselves in the soil and feed upon roots, sometimes when in great numbers doing considerable damage to crops. The young is a curious-looking wingless insect with the front legs fashioned like the claws of a crab. When nearly adult they sometimes betray their presence by building on the surface of the ground hollow columns of earth in which they reside before emerging as fully-developed insects.

**Cicero Marcus Tullius** (106-43 B.C.) Roman orator, author and politician, studied rhetoric, law and philosophy in Rome and Athens. When 28 he established his reputation by his defence of Sextus Roscius. His prosecution of Verres (70 B.C.) and Catiline (63 B.C.) and his defence of Cluentius (66 B.C.) earned him fame. He was made Consul in 63 B.C. and Governor of Cilicia in 52. Under Caesar he took no part in politics but after the latter's murder in 44 he supported Octavian in the Senate. But he was proscribed by the latter's supporters and killed at his villa at Formiae. His works include treatises on oratory and philosophy and many letters to his friends. The latter are a highly valuable source of information concerning the history of his period. He also wrote much verse and his more famous speeches, including the *Philippics*, still survive. See also *ROME*, *HISTORY*, *PHILOSOPHY*, *ANCIENT*.

**Cid, The** [sid or thid] Spanish hero of 11th cent. whose largely

**Church, Richard William** (1815-1890), Dean of St Paul's (1871), a chief member of the Oxford Tractarian movement, and a noted literary critic. He founded *The Guardian* in 1846.

**Churchill, Charles** (1731-1764), English poet, author of the *Rosciad* (1761), a satire on contemporary acting. He contributed political satires to the *North Briton*.

**Churchill, Lord Randolph** (1849-1895), British statesman, son of the 7th Duke of Marlborough. He entered Parliament 1874, and formed (1880) the Fourth Party (*qv*), as critics of the Liberal administration. Became the champion of progressive Conservatism or "Tory democracy," 1883, and virtual leader of the Conservatives. Was Secretary of State for India under Salisbury, 1885, and Chancellor of the Exchequer and Leader of the House, 1886. Resigned over dispute on military estimates, and toured S Africa, 1891. Re-elected to Parliament, 1892, he opposed Gladstone's second Home Rule Bill.

**Churchill, Winston Leonard Spencer** (b 1874), statesman, elder son of Lord Randolph Churchill, served with the British Army in India (1897-8), the Sudan (1899), and in S Africa (1899-1902). He was elected Conservative M P for Oldham in 1900 but joined the Liberals, and served as Under-Secretary for the Colonies in the Campbell-Bannerman administration of 1905. As President of the Board of Trade in 1908 he introduced labour reforms. He became Home Secretary under Asquith, and a supporter of Irish Home Rule. Churchill was appointed First Lord of the Admiralty in 1911 to form a naval war staff, and was largely responsible for the preparedness of the Fleet on the outbreak of war in Aug 1914. He directed a brigade at the siege of Antwerp in Oct., and planned the E naval campaign with Lord Fisher, but Fisher's opposition to the Dardanelles enterprise of April, 1915, led to Churchill's resignation.

He served in France in 1916, and

reorganised war supplies as Minister of Munitions under Lloyd George in 1917-18. As Secretary for War he gave aid to the White (anti-Bolshevik) Armies in Russia in the years 1918-21. Churchill was, next, Secretary for the Colonies till the Coalition Government's fall in 1922. In 1924 he was appointed Chancellor of the Exchequer under Baldwin's Conservative administra-



Winston Churchill

tion. He advocated a return to the gold standard, the extension of national and imperial preference in 1926, the McKenna and other duties of 1926, and derating. He is the author of *The River War* (1898), *The World Crisis*, in 4 vols (1923-9), *Marlborough* (1933), and other works.

**Churchill, Winston** (b 1871), American novelist, is the author of *Richard Carvel* (1899) and its sequel *The Crisis* (1901), and of *Comston* (1900), *The Dwelling Place of Light* (1917), etc.

**Churching**, Christian ceremony used in the Anglican and Roman Catholic Churches, in which mothers give thanks shortly after the birth of a child.

**Churchwarden**, ecclesiastical and

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Cicadas are found in the warmer parts of the world, one of the best known being a N. American species called the 1-year locust because of its appearance in vast numbers at intervals of about that period. The explanation of this is that the larva takes from 13 to 17 years to reach maturity. The female cicadas lay their eggs in the branches of trees and the young on hatching fall to the ground, bury themselves in the soil and feed upon roots, sometimes when in great numbers doing considerable damage to crops. The young is a curious-looking wingless insect with the front legs fashioned like the claws of a crab. When nearly adult they sometimes betray their presence by building on the surface of the ground hollow columns of earth in which they reside before emerging as fully-developed insects.

**Cicero** Marcus Tullius (106-43 B.C.)

Roman orator, author and politician, studied rhetoric, law and philosophy in Rome and Athens. When 6 he established his reputation by his defence of Sextus Roscius. His prosecution of Verres (70 B.C.) and Catiline (63 B.C.) and his defence of Clodius (58 B.C.) earned him fame. He was made Consul in 63 B.C. and Governor of Cilicia in 59. Under Caesar he took no part in politics but after the latter's murder in 44 he supported Octavian in the Senate. But he was proscribed by the latter's supporters and killed at his villa at Formiae. His work includes treatises on oratory and philosophy and many letters to his friends. The latter are a highly valuable source of information concerning the history of his period. He also wrote much verse and his more famous speeches including the *Philippics* still survive. See also *Roman History, Philosophy, Ancient*.

**Cid, The** [pron. THID] a Spanish hero of 11th cent. whose large

legendary deeds are chronicled in the *Poema del Cid* and the *Chronicle of the Cid* (12th cent)

**Cider**, beverage made by the alcoholic fermentation of apple juice. Its manufacture, originally a farm and cottage industry, has now been modernised, with resultant improvement in the uniformity of the product. The apples employed are known as cider apples, many varieties exist.

The fruit is reduced by machinery to a fine pulp, from which the juice, called *pomace*, amounting to from 75 to 80 per cent of the weight of the apple, is pressed by hydraulic pressure. Fermentation is effected by yeast, and is carried to a greater degree the drier the product desired. The cider is then filtered.

**Cigars and Cigarettes** Tobacco (*q v*) requires careful curing before it can be applied to the manufacture of cigars and cigarettes or used for smoking in the pipe. The leaf is first dried either by sun and air or by artificial heat, it then turns yellow, and requires to be exposed to moisture in order to cause it to become pliable. Afterwards a process of fermentation is allowed to take place, resulting in the disappearance of the starchy and sugar constituents, and improving the flavour. It then requires to be aged in a tightly pressed condition at a suitable temperature.

Cigars are always made by hand, and consist of a central core of small leaves and cuttings, followed by a "bunch wrapper," and finally an outer wrapper of the best grade of leaf. The stalks are removed from the leaves before making into cigars, when ground they form snuff. The outer cover is fixed by means of gum. Cigars are also made having a central hole filled by a reed which is withdrawn before smoking. Cheroots are

open at both ends, and do not require cutting before smoking.

Cigars are best packed in cedar-wood boxes, in which the flavour lasts unimpaired for several years, if the cigars are kept under suitable conditions. The best cigars are made in Cuba, and the use of the word Havana for cigars from any other place is an offence against the law. They are made also in Mexico, Manila, and India, among tobacco-growing districts, while enormous numbers of the cheaper grades are made in Britain, Holland, Germany, and Belgium, Havana leaf being used for the wrappers, and various other tobaccos for filling.

Cigarettes, which consist of tobacco wrapped in a paper tube, have grown rapidly in popular favour of recent years. In the case of some brands the paper tube is tipped with cork, gold leaf, and other substances, to prevent the lips from adhering to it. Cigarettes are made by hand either by rolling the tobacco in the paper, afterwards wetting the gummed edge of the latter and closing it, or by pushing the tobacco into the finished paper tube by means of a wooden stick.

Most cigarettes are now made by machinery, which has been brought to great perfection, and works at a very high speed, 60,000 cigarettes an hour or more being made by a single machine.

Virginia cigarettes are made from tobacco grown in Virginia, N Carolina, S Carolina, and Georgia, though tobaccos from other parts of the United States are also used in their composition. Turkish cigarettes are made from Turkish tobacco, but the cheaper grades are made from a blend of tobacco derived from Bosnia, Macedonia, Bulgaria, and to some extent from the Far East. French cigarettes are made mainly from Algerian tobacco.





